THE PSYCHOLOGY OF THE THINKER

THE PSYCHOLOGY OF THE THINKER

BY

I. B. SAXBY, D Sc.

LECTURER IN EDUCATION, UNIVERSITY COLLEGE, CARDIFF

WITH NINE DIAGRAMS

LONDON

UNIVERSITY OF LONDON PRESS, LTD

10 & 11 WARWICK LANE, E.C.4

1926

Printed in Great Britain for the UNIVERSITY OF LONDON PRESS, LTD
by HAZELL WATSON AND VINEY LD London and Aylesbury

PREFACE

This book is an attempt to give the teacher of adolescents and adults an account of the psychology of thinking in the light of our present knowledge of the unconscious. Generally speaking it deals with man's efforts to satisfy his desires in spite of obstacles and with the ways in which these efforts may lead on the one hand to problem-solving, on the other to phantasy-thinking. In regard to problem-solving it is concerned with the development of thought processes and the use of concept as a "thinking-tool"; in regard to phantasy-thinking, with the growth of interests, the function of literature and art and the search for technique to which the latter gives rise.

As lecturer in education, I have often felt the need of a book which would give the student an insight into the psychology of modern methods of investigation. In the present work I have therefore devoted several chapters to this subject, and have tried to emphasise its practical importance by giving enough biographical material to show the pitfalls to which workers have been exposed, and the methods by which they have sought to avoid them.

In the study of modern psychology the relation of conscious to unconscious processes always presents a serious difficulty to the beginner. But I feel

inclined to think that this difficulty is largely due to the fact that the word "unconscious" suggests something which is merely the opposite of the conscious—a suggestion which is at times very misleading. In order to avoid this difficulty it has seemed worth while to adopt the terms *engram* and *ecphory* which Semon introduces in his book *The Mneme*, and which have the advantage of carrying no meaning other than that which Semon gave them. This may make the first few chapters seem unnecessarily difficult, but I think the student will find that the adoption of Semon's terminology adds so much to the clearness with which ideas can be presented that it is worth his while to familiarise himself with it.

I should like to take this opportunity to thank various friends for the help they have given me, more particularly Miss Alice Woods, who read the whole of the manuscript for me, and Miss E. R. Murray, who has allowed me to use her unpublished records of the behaviour of young children I am also indebted to Mr Robert Graves and Messrs. William Heinemann for permission to quote Section XIX of *On English Poetry*, and to Professor Kohler and Messrs. Kegan Paul, Trench, Trubner and Co. for permission to reproduce Fig. 12 of *The Mentality of Apes*.

I. B. SAXBY.

CARDIFF
January 1926

CONTENTS

SECTION I

THE FUNCTION OF THOUGHT

SECTION II

THE THOUGHT-PROCESSES

SECTION III

THE ACQUISITION OF KNOWLEDGE

SECTION I

THE FUNCTION OF THOUGHT

INTRODUCTION

"EVERY act we perform is a new thing made, a new creation, which has never been seen on earth before; and yet each one is an imitation of some model and an effort after some aim. And thus we proceed, so far as our life is voluntary, and not mechanical, towards an end which can never be attained, and is always changing as we change, but which is in its essence the thing which at each successive moment we want most to be. We cannot define it more. 'Infinite beauty in art, infinite understanding in knowledge, infinite righteousness in conduct' . . . such words all ring false, because they are premature or obsolete attempts to define, and even to direct, wants that are often still subconscious, still unformed, still secret, and which are bearing us in directions and towards ends of aspiration, which will doubtless be susceptible of analysis and classification when we and they are things of the past, but which for the present are all to a large extent experiment, exploration, and even mystery. But we can be sure with Plato that the two things that determine the way of life for each one

of us are, as he puts it, 'The road of our longing, and the quality of our soul.'"[1]

Thus Professor Gilbert Murray in one of his essays.

I have quoted the passage here, because it gives so vivid and yet so concise a description of the attitude towards thought and thinking which has been adopted in the present investigation. It shows us thought as a tool in the service of desire, though that desire may be but dimly understood or even misunderstood, and it shows us the thought-process, as a means towards an end, though that end too may be only partially realised.

Unless an individual has been overwhelmed by the obstacles which he has encountered, he is not prepared to take the world as it is, and he, consequently, regards the obstacles which he encounters as things which have to be removed or at least evaded. In this way he becomes aware of ends which he wants to achieve, and of means towards those ends. Together they make up his thoughts. As will be shown in detail in what follows, thoughts are only produced under the impetus of a felt need, though that need may be conscious or unconscious.

It is from this point of view that thought and thinking will be discussed here. The discussion has been divided into three parts—(1) The function of thought and thinking in the life of the individual;

[1] Gilbert Murray, *Essays and Addresses*, pp. 123–4.

(2) the problems which arise in connection with thought-processes, as in acts of recall or construction; and (3) the difficulties which are encountered in the acquisition of knowledge.

In the present section we shall be concerned with the function of thought in the life of the individual. It will, however, be necessary to begin with certain preliminary considerations.

CHAPTER I

THE ENGRAM THEORY

In psychology it is still often considered necessary to apologise for the introduction of unfamiliar terms. In every other science we expect to find a vocabulary of artificial words which has been created to meet its special needs. In psychology alone the invention of new words tends to be deprecated as an unnecessary obstacle to the comprehension of the ideas which the writer is trying to convey.

There can be no doubt that the introduction of technical terms actually does make a discussion more difficult to follow until those terms have become familiar, but what is not always realised is that the difficulty really lies not so much in the term as in the idea which it is intended to express. It is this new idea, this new grouping of qualities, which has to be borne in mind if the discussion is to be followed in a critical spirit, and the new term is only irritating because it forces us to become aware of the fact that we are dealing with a grouping which presents unfamiliar features, and is consequently liable to involve us in unfamiliar problems.

The evolution of new ideas is the aim and end of

all scientific work. The choice lies, therefore, between the construction of artificial terms and the adaptation of popular words. If a popular word carries the required meaning, it is obviously the word to use. But in practice there is often no word which carries exactly the right shade of meaning, or, if there is such a word, it often carries other meanings as well. In such cases the popular word has to be defined in a more or less artificial way before it can be used, and the special meaning which it has been given has then to be borne in mind throughout the ensuing discussion. The *worker who uses a popular word in a special sense* has, therefore, to remember the fact that a familiar word is being used in an unfamiliar sense as well as the exact sense in which it is being used. In contrast with this, the worker who uses a technical word has only to remember the meaning which it carries, and whilst the term is unfamiliar its very strangeness will remind him of the fact that he is dealing with an idea which is new to him. Thus the introduction of a technical term is a distinct aid to accuracy of thought, whenever there is no popular word which carries exactly the required meaning.

For the purposes of the present discussion I propose to adopt the following technical terms: *stimulus*, *engram*, *ecphory*, and *configuration*. The first three are from *The Mneme* of Semon, the fourth from Koffka's *Growth of the Mind*. All these terms

will be used freely throughout the book. As will be shown presently, their value lies in the fact that they cannot mislead the thinker by suggesting either the presence or the absence of conscious awareness.

Stimulus

A stimulus is an action on an organism which produces a physiological change within that organism and is consequently followed by certain specific effects, some of which are entirely physiological, others partly physiological, partly psychological. These effects fall into three groups·

(1) The first group consists of sensory reactions which result from impressions, such as those of light, heat, pressure, etc. These produce sense-experiences of all kinds. Thus the light which is reflected from the box opposite me affects the retina of my eye in such a way that I have a sense-experience, which past events has taught me to interpret as the perception of a box. Sense-experiences have the peculiarity that they can only be perceived by the individual himself, and can therefore only be measured and described by him.

(2) The second group consists of reactions which can be perceived by the observer. The change may be a process of growth, the contraction of a muscle or processes of metabolism, such as for instance the production of heat and perspiration, which is a normal accompaniment of vigorous exercise.

It is characteristic of a great many of these reactions that they do not occur in the part of the organism which has been stimulated. This is more particularly the case in animals which have a central nervous system, for the nerve tissue is an irritable substance, which has the power of conducting the effect of a stimulus. When a child cries at the sight of a big dog, the light-rays which are being reflected from the dog to the retina are functioning as stimuli, but the reaction of which the observer becomes aware is in the form of vocal expression and tears. Hence the effect of the stimulus must have been conducted from the nerves of the retina to those which control the activity of the vocal cords and the tear glands.

(3) The third group consists of the changes within the nerve substance itself. This group is of great interest to the physiologist, but for our purpose it is sufficient to realise that such changes occur. They will not concern us directly in our investigations.

Thus the two main effects of stimulation are (1) the immediate sensations and (2) effects which are observed on organs which are remote from the part which is being stimulated. In addition to this the stimulus also affects the nerve tissue, which acts as conductor. Though the effects of a stimulus may be so different, they all have one feature in common, namely, the production of a physiological change within the organism. A physiological change in-

volves physiological activity or excitation. Hence it must be assumed that a stimulus produces an energetic process of some kind within the organism. In our present state of knowledge it is still impossible to state what these energetic processes are; however, it will be convenient to be able to refer to them at times, and it is therefore necessary to give them some name. I shall use the vague term *nervous energy* for that which produces the excitation and the phrase *flow of nervous energy* for the conduction of the effect of a stimulus through the nervous system. It should be noted that these terms are intended to convey no theory as to the kind of change which actually takes place; they are simply shorthand formulæ which are introduced for the sake of greater conciseness.

Engram and Ecphory

If an observer looks at a bright red light, and then looks away, he will have certain after-images, but presently these will fade away, and there will be no further apparent result of the stimulus. All the same the light must have left some more permanent trace, for it will be recognised as the same light, or as a light of the same colour, if it is seen again after a short space of time. This is by no means a peculiarity of the human being; it applies equally to plant, protist, and animal. If a phenomenon is able to function as a stimulus at all, that is to say,

if it is able to produce a reaction of some kind, it tends to produce a permanent change as well.

This permanent change Semon calls an *engram*,[1] because it has as it were been engraved on the irritable substance. And the action of the stimulus which produces a permanent change he calls for the same reason its *engraphic*[2] action.

It follows that we infer the existence of an engram from the fact that the second application of a stimulus produces a reaction which is in some way different from that of its first application. In other words it is the engram, or the change which has been wrought, which causes the nervous energy to take a different path when a stimulus is repeated after a suitable interval. Semon uses the term *ecphory*[3] for this effect.

To sum up: A stimulus tends to produce a permanent change within the organism which is termed an *engram*. When that stimulus is repeated, the energy which it sets free *ecphores* the engram, that is to say, it flows through the changed part of the organism. And the result of this ecphory tends to be a diversion of the energy into a different channel, an effect of which the observer becomes aware, because a change of path necessarily leads to change of reaction.

[1] Gk *gramma* = that which is drawn or written, *en* = in.

[2] Gk. *grapho* = to scratch or draw, *en* = in.

[3] Gk *phora* = a bringing forth or producing, *ek* = out of.

NOTE

Analogies are apt to be misleading. All the same it may be found helpful to compare the engraving of engrams and their ecphory with the recording of sound-waves and their reproduction on a gramophone.

To record sound a disc of e.g thin glass is placed in such a position that it catches the sound-waves in the air and vibrates in the form they take (like the drum of the ear) The disc has a sharp point, which, when set in position, just presses upon the surface of a specially prepared metal plate, and this plate is made to revolve in such a way that the sharp point passes over it in a spiral When the plate is revolving and the disc is set in position, the sharp point consequently records the vibrations of the disc as a series of indentations on the plate. If this plate (or a " print " of it) is later placed in position on the gramophone, the gramophone needle passes over the indentations, is thus caused to reproduce the original vibrations, and hence the air-waves which gave rise to them. (And it is of course these air-waves which affect the drum of our ears in such a way that we become aware of a reproduction of the original sounds)

If I may be allowed to take the recording plate to represent the living organism, then the sound-waves stand for the stimuli, the disc with the sharp point for the sense organ, and the indentations on the film of the plate for the engrams which are formed by the action of the stimuli Further, when the sound-waves are being reproduced with the aid of the gramophone, the placing of the needle in position may be taken to stand for a repetition of the stimulus, and its vibration, as it passes over the indentations, for the ecphory of previously established engrams. Finally, the fact that the instrument must be wound up, that is to say, that the plate must be rotating, may perhaps be taken as an equivalent for the fact that stimuli can only ecphore engrams if the organism is in a sufficient state of tension to be more or less ready to ecphore. (For this last point see Chapter VI.)

CONFIGURATION

Under natural conditions stimuli always occur in groups or "sets." As Semon points out, even a ray of sunshine produces a number of stimuli. "When the sun breaks through the clouds and shines on a plant, not a simple but a highly complex change of the energetic condition is produced, and different kinds of radiant energy, such as ultra-red heat rays, various light-rays, and chemically acting ultra-violet rays, act as many stimuli on the organism" (*The Mneme*, p. 35).

Owing to the Law of Association by Contiguity engrams which are formed together (or in close succession) tend to ecphore together (or in close succession), so that isolated engrams must be as rare as isolated stimuli. When a new stimulus-set acts on an organism, it engraves new engrams on it, but at the same time it also ecphores previously established engram-sets. Once this has occurred, the new set will ecphore as a whole, whenever a suitable stimulus impinges upon it. Thus a strange sound engraves new engrams, but it also ecphores the engram-sets which enable us to class it as sound, and the engram-sets which make us aware of it as "strange" or "unknown." If the sound is then repeated after an interval, we may become conscious of it as "the sound which seemed so strange the first time we heard it," that is to say, the first experience of the sound causes the

individual to acquire a new engram-set, and that engram-set thereupon ecphores as a whole, when the sound is repeated.

When a number of engram-sets become associated together in such a way that they function as a whole, they form an associated group. It will be convenient to call such a group a "configuration" of engrams.

Koffka defines a "mental configuration" as "a co-existence of phenomena, in which each member carries every other, and in which each member possesses its peculiarity only by virtue of and in connection with all the others."[1] It will be seen that the sense in which I propose to use "configuration" is the equivalent of this in terms of the engram theory.

"The sound which seemed so strange the first time we heard it" becomes conscious as a mental configuration, no part of which would have the same meaning, if it were separated from its context. But this item of awareness is due to a group of engram-sets, which have become associated together in such a way that they tend to ecphore together, that is to say, to a configuration of engrams.

Sometimes the growth of a configuration depends on the selection of relevant elements to the exclusion of the rest. As an instance of this we may take the way in which a child learns to use the word "table" correctly. A child who is learning to speak hears

[1] *The Growth of the Mind*, p 131

the word "table" in connection with a number of stimulus-sets, each of which forms its own engram-set. He also uses the word himself, sometimes correctly, at others incorrectly, and each time an engram-set is formed. But the child wants to use the word rightly, and in consequence of his effort the engram-set for the word "table" gradually becomes associated with the engrams which are ecphored by all tables, with the result that he presently acquires the group or "configuration" of engrams which enables him to use the word correctly.

Inborn Engrams

We have so far considered the engraphic action of a stimulus-set, as though there were nothing to guide the flow of energy within the organism, until experience has provided the necessary engram-sets. But this is of course nothing more than an artificial simplification of the problem. In reality each young organism is endowed with the forms of behaviour which are vital to its existence.

I am using the term "behaviour" in the wide sense in which it includes all changes that take place within a living organism, that is to say, processes connected with the building up and breaking down of protoplasm, as well as the contractions of muscles, and the production of emotion and thought. Taken in this sense every form of behaviour is a reaction to a stimulus-set, and an inborn form of behaviour

is consequently a reaction to a stimulus-set, which exists prior to any experience, or, to put the same thing in different words, a tendency for the nervous energy which is set free by certain stimuli to take "paths" which are determined by the constitution of the organism. These paths are due to changes which have been wrought in the germ plasm in the course of the evolution of the species to which the organism belongs. In any particular individual the inborn forms of behaviour are, therefore, due to the engrams with which he is endowed at birth. To understand the growth of engrams, we should have to know the series of changes which a stimulus produces within the simplest form of living matter —the protoplasm—but all we can do in practice is to observe the final reaction. How such a reaction is produced is at present at any rate beyond our power to determine. On the other hand, we do know from direct observation and experiment that every living organism is capable of forming engrams under the influence of experience, and that certain of these engrams tend to be inherited, if the conditions are suitable. As an instance, we may take the amœba, which at first sight appears to be nothing more than a microscopic mass of naked protoplasm. We find that the amœba is endowed with engrams which enable it among other things to flow round and ingest its food, to build up fresh protoplasm from the nutritive part, and to flow away from or excrete what

it cannot use. Amœbæ abound both in fresh water and in salt water, but this is due to a process of adaptation, for a freshwater species is incapable of living in salt water. If members of a freshwater species are placed into water which is very slightly salt, some of them survive and continue to multiply, whereas others die. If the survivors are then placed into water which contains a little more salt, a proportion will again die, whereas others will again survive. And by increasing the amount of salt gradually, it is possible to produce in the end a new species which differs from the old, in that it is able to flourish and multiply in ordinary sea-water. This is an instance of what is known as adaptation to environment. Biology teaches us that adaptation to environment is one of the fundamental tendencies of living organisms. Whenever the environment changes in a vital manner, the new stimuli produce new engrams, some of which become hereditary; and in every case the individuals who are adaptable survive, whereas the rest perish. The result is the struggle for existence and the survival of the fittest. To the human observer the behaviour which this induces seems to suggest the existence of an urge to live, an *élan vital* in every organism from the lowest to the highest, though this term is perhaps misleading when it is applied to creatures who have not yet acquired a minimum of self-awareness.

The amœba is a speck of naked protoplasm, a

single cell which can perform all the vital functions of life; it can breathe, it can feed, and it can propagate its species. But in the higher animals, groups of cells tend to become differentiated, some for breathing, some for feeding, some for propagation, some for movement. The result is of course loss of independence on the part of the individual cell, but this is more than balanced by the increase of efficiency, which becomes possible when an organism consists of a system of cells, each group of which has been specialised for some particular purpose. As an instance, we may take the nervous system, a group of cells, which has become differentiated as a conductor of nervous energy. It has been shown that the extent to which a species can adapt itself to its environment depends on the development of its nervous system, more particularly its brain. As we go up the scale of life, we find an increase both in the weight and in the complexity of the brain, until we come to the human being, the most adaptable of all creatures, who has also a bigger brain than any of them.

The Reflex and the Impulse

In the course of this process of specialisation under the influence of the struggle for existence, the human race has evolved two mechanisms for controlling the reaction to stimuli—the reflex and the impulse.

The reflex is an inborn tendency to react to a particular stimulus in a particular way. The digestive processes, breathing, coughing, starting at a noise, and blinking to keep dust out of the eye, are all instances of reflexes. Some are able to produce conscious awareness, others are not; some can be controlled for a while, others cannot. The essential thing about them is that they are fixed, and therefore incapable of modification. They adapt the individual to that part of his environment which is not likely to change. All the same, as the student of physiology knows well enough, they are able to produce results which are quite as wonderful as anything which we can do with the aid of what we are accustomed to call our higher powers. To give a definite instance In children who suffer from a weak heart, the valves of the heart sometimes do not close properly, with the result that the blood is not pumped through the body at a rate which will enable the individual cells to receive the food and oxygen which they need, and to free themselves from the waste which they produce. It is found that this lack of proper circulation tends to stimulate the muscles of the heart in such a way that they increase in bulk, and are consequently able to compensate for what is lost through leakage by driving the blood through the body with greater force. When hygienic conditions are good, this often succeeds in a wonderful manner. It is an instance of the way in which

the urge to live may express itself in human beings, without rousing the least awareness within the conscious self. Another instance is found in that large store of engram-sets which ensures that each young individual is true to his species in certain essentials, without being exactly like his fellows: the offspring of human beings is always another human being, but it may be tall or short, dark or fair, and so forth.

An impulse may be defined as a tendency to respond to a particular type of stimulus by a particular type of reaction. The urge to avoid danger, to overcome obstacles, to seek a mate, are examples of impulse. They are expressions of the urge to live, and as such fall, broadly speaking, into two classes, those which make primarily for self-preservation and those which make primarily for race preservation. Impulses differ from reflexes in that they are educable. We are born with an urge to avoid pain, but we have to learn what is painful, and how it is to be avoided. Hence each can learn to avoid the stimuli which are harmful in his own particular environment—one child learns to avoid bulls, another motor-cars. Our endowment of impulses consequently enables us to adapt ourselves to a far larger range of environments than would be possible if our behaviour were governed entirely by reflexes. On the other hand, the existence of reflexes is essential to impulsive behaviour; the impulse to overcome obstacles will lead the baby

to push or pull what is in its way, but this pushing and pulling is only rendered possible by the reflexes which enable him to grasp objects and to move his arm backwards and forwards. It would not be difficult to show that impulsive behaviour leads to the organisation of reflexes in service of the impulse, so that impulses tend to produce configuration of engram-sets, which have proved useful in practice—a headlong burst of rage in one case, skilful fighting in another, and perhaps complete repression in a third.

Conditions for Stimulation

Before concluding this chapter it will be convenient to consider the conditions under which an event is able to function as a stimulus.

A stimulus is as we know an action which produces a physiological change, and is followed by certain specific reactions. Hence an event functions as a stimulus if it produces a reaction within the organism in which it is acting.

Clearly one condition is the existence of a suitable receiving organ. A cold poker in a dark room will escape notice, unless the hand touches it accidentally, for we have no means of perceiving it at a distance, a hot poker which is reflecting dark heat rays will attract attention, if the hand passes at a short distance from it, but it will only be perceived vaguely as a source of warmth, whereas a red-hot poker will stimulate the nerves of the eye

as well as those which are sensitive to heat, and will consequently be perceived as an object of a definite shape, size, and colour, even if we are too distant from it to experience it as a source of warmth. As the wireless has taught everyone of late, we are, as a matter of fact, surrounded by vibrations, of which we know nothing until we discover some means of registering them.

Even if the organism has the necessary receiving organ, an event may, however, fail to function as a stimulus if it is unable to ecphore inborn engrams.

We may go down a road again and again without noticing what it is called, or we may be vaguely aware that there are shops in it without knowing what they sell These are objects which could one and all function as stimulus-sets, and which do function as such when they are able to satisfy some need of the self. But they pass unnoticed until they are wanted. All the same, the shop which has a nodding figure in its window usually attracts our attention, even though it has nothing that we want. This is due to an inborn tendency to look at a moving object, when it appears on a stationary background, a tendency which must have had great survival value under primitive conditions when every moving form might mean food or danger.

The tendency to look at a moving object is a true reflex, and as such it always functions, though we are not always conscious of the reactions which it produces. Walking along the road absorbed in

thought, we avoid collisions, without becoming aware of the people who are approaching us; for experience has made the stepping aside a mechanical reaction, which no longer needs help from the conscious self. However, if the stimulus-set means urgent danger, it rouses conscious awareness, even though the self is absolutely helpless. We are, for instance, not likely to go on dreaming if a car is mounting the pavement in front of us in a vain attempt to avoid a collision.

I shall return to this point in a later chapter. The illustrations I have given will, however, be sufficient to suggest that an event can only act as a stimulus, if there is a suitable receiving organ available, and if it can ecphore previously established engrams.

These engrams may be entirely inborn as in the case of the reflex and the impulse. They may, however, be partly inborn and partly acquired as in the case of the reflex which has become associated with an acquired form of behaviour, or the interest which, though itself acquired, owes its driving force to the fact that it is derived from one or more of the primary needs of the self.[1]

To sum up: Every individual is endowed with a large store of inborn engram-sets, which determine from birth, whether an event is or is not able to act as a stimulus. Every stimulus produces reaction as well as an engram. And an engram which has the necessary degree of permanency

[1] Cf. Ch. V.

tends to affect the reaction of the organism when the corresponding stimulus is repeated.

The human being is capable of becoming aware of some of the mental processes which go on within him. When he becomes aware of a stimulus-set, he refers to it as a percept. When he becomes aware of the ecphory of engrams, he says he is recalling something which happened in the past, or recognising an object which he has seen before. And when he is discussing the rate at which he can acquire effective engrams he usually talks about the quality of his memory. The reason for introducing the terms ecphory, stimulus, etc., is that they apply equally to conscious and unconscious phenomena, whereas the corresponding terms recall, percept, etc., are liable to mislead us on account of their customary association with the activities of the conscious self. The importance of this distinction will become evident in the course of the discussion.

CHAPTER II

THE GROWTH OF MEANING

THE study of behaviour teaches us that the primary urge to live expresses itself through two fundamentally different mechanisms—the reflex, which ensures correct behaviour in the environment for which it is meant, but leaves the individual helpless when the environment changes, and the impulse, which is useless until the individual knows something about his environment, but of far greater ultimate value because it enables each one to adapt his behaviour to his own peculiar needs.

Thanks to his impulses the child is able to adapt his means to his end, and to classify his experiences in relation to his needs. He learns that " please " usually produces what he wants, but that it is wise to ask people when they are in a good temper ; he learns that pencils produce marks on paper, but that adults do not like him to use printed books for this purpose. We are so familiar with this tendency, that we rarely realise the complexity of the mechanism on which it depends.

It is often stated that the process which we call " learning from experience " depends on memory or, in terms of the engram theory, on the tendency

of engram-sets to ecphore under suitable conditions. This is of course true as far as it goes. If stimulus-sets did *not* produce engram-sets, and if those engram-sets were *not* liable to ecphore under suitable conditions, an experience would always seem new, no matter how often it was repeated. Under such circumstances it would be impossible to learn anything either consciously or unconsciously. But on the other hand "memory" does not explain the way in which one experience often affects our reaction to a number of different stimulus-sets. It does not account for the fact that the child who has been frightened by a poodle may thereafter be afraid of all dogs and cats. The fact that we have the power of recalling the past only explains why previous experience affects our behaviour when the identical situation recurs It is, for instance, sufficient to show why the child who was frightened by a poodle shows fear when the same poodle approaches him again in the same manner. But such a limited form of learning would have little survival value since two experiences are rarely alike in all their details. What gives the phenomenon its importance is just the way in which one experience is able to affect our behaviour in a number of different situations.

In our illustration the child is afraid of all dogs and cats, not merely of the one dog who frightened him. In other words, all dogs and cats automatically suggest danger to the child after his one

experience with one particular dog. From the onlooker's point of view he has therefore classified cats and dogs as "dangerous." But this makes the process seem far more deliberate than it really is. It would be more correct to say that the experience has affected him in such a way that certain parts of the original stimulus-sets are now able to produce the impulsions initiated by the original experience, even though they occur in a stimulus-set which is quite different in other respects.

The engram theory will enable us to represent these facts symbolically in a diagram. (In studying this and similar diagrams the reader should, however, be careful to bear in mind that the engram is not a known physiological unit. It is "the change which is wrought in an organism by the stimulus which acts on it." We know that some change has been wrought because the organism behaves differently when the stimulus is repeated. What the change is we usually do not know, nor does it concern us for our present purpose.)

In the diagram which is given below *s* stands for stimulus-set, *e* stands for engram-set. Suffixes are used to differentiate between different stimulus-sets and engram-sets, thus s_{dr} is the stimulus-set produced by a *d*og which is *r*unning towards the child.

We will take the case of a child who is not yet very safe on his feet, and who loses his balance in trying to avoid a dog. The dog who runs up to the

child then acts as a stimulus-set (s_{dr}), which produces certain engrams and ecphores, others, forming together an engram-set (e_{dr}). Since the child is only learning to walk, this dog is an obstacle to his safe progress. Hence e_{dr} will include certain engrams from the urge towards self-preservation (e_{sp}). We will suppose that the child tries to step aside,

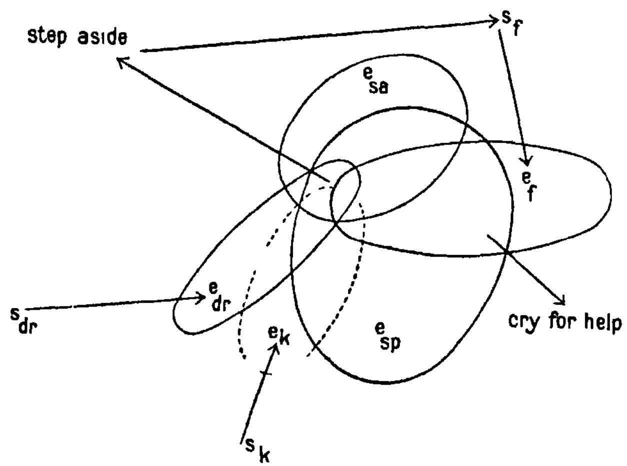


FIG. 1.

and falls down. In that case he must previously have acquired engram-sets connected with stepping aside (e_{sa}) which are already associated with e_{sp} and thus readily roused by s_{dr}. In this particular case the child falls down and hurts himself, that is to say, the fall acts as a stimulus-set the most prominent part of which is the element of pain; this rouses once again the urge towards self-pre-

servation, so that the resulting engram e_f again contains elements from e_{sp}, which this time find expression in the primitive cry for help. But, as we have seen, this is not all that happens. In practice one bad fall may make the child afraid of all dogs and cats. In other words, a stimulus-set s_{dr} may affect the engram-sets of a child in such a way that another stimulus-set s_k may thereafter produce the same cry of help, though its engram-set e_k only ecphores some of the engrams of e_{dr} (see diagram). Moreover, the engram-set e_{dr} contains elements which are incapable of rousing fear in a different setting. The child who has been frightened by a white dog is not thereafter afraid of every white object, and a child who is afraid of a cat which is running towards him may yet be willing to stroke pussy asleep on the hearthrug. In our case it was awareness of a quickly approaching obstacle that caused the child to fall down, and as a result of this experience only the elements which stood for "something running towards me," or perhaps "something big running towards me," became associated with engrams from the self-preservative tendencies in such a way as to produce the idea of danger when they recurred.

The point is so important that I may be forgiven for re-stating it from another angle. It is not that the child realises that fox terriers, poodles, and bull-dogs are different creatures, who are alike in this one respect, that they are liable to cause him to fall

down by running at him. It is that he does not realise them as individuals at all. Whatever the animal which is running towards him, the engram-set he has formed under the influence of a bad fall causes immediate awareness of danger, and he sees nothing else because nothing else matters for the moment.

In the same way a child of two who was given the word "duck," when he saw wild ducks flying over the water, for a time used that word indiscriminately for birds and aeroplanes and kites. What had interested him was evidently the flight of the duck, and while that interest lasted all that could fly attracted his attention. In other words the new configuration concerned "flying things," the source of interest being possibly the fact that he could not fly himself. It is true that he labelled his configuration "duck," but that was the fault of the adult who assumed that his "What is it?" applied to the bird as such, whereas it really applied to the act of flying.

In general it would seem that the configuration which is formed in response to a particular stimulus-set only includes within it the elements which attracted the attention of the individual at the time. And this applies just as much to the adult as to the child. If anyone doubts this, he should try to describe in detail the buses or trams of his own native town. He will probably be surprised to find how little he really knows about them. As a rule,

all he needs to know is the distinguishing marks on the buses and trams which serve his part of the town, and enough about their structure to be able to board them, and to secure a seat for himself. And as a rule that is just about all he does know about them. If new lines of buses are started, he may never become aware of their existence—to him these buses are merely "the wrong number." They form part of the class of buses which are of no use to him.

Thus we tend to think in terms of types or classes. We group stimulus-sets as mine or thine, as friends or foes, as apples, trees, or chairs, and we only notice the marks that are already familiar unless the behaviour they suggest produces an unexpected result—such as might happen in a first encounter with a Jack-in-the-box.

Now and again an individual becomes of such importance to us that we are driven to realise his uniqueness, but even then we cannot escape our tendency to classify. If we describe him as tall, thin and clever, all we really mean is that he belongs to the classes of "tall persons," thin persons and clever persons, and if we wish to describe him in detail all we can do is to give as complete and exact a list as possible of the classes to which he belongs from different points of view. If we are told he belongs to the class "6 ft. in his socks" we know more than if we were told he is tall. In fact our life is governed at every turn by this tendency to see the old in the new. In unreflective behaviour

it is responsible for the fact that the reaction to a new stimulus-set depends on those of its familiar elements, which are ecphored by the predominant need of the moment. In reflective behaviour it causes us to think of the individual event in terms of such types or classes as are relevant to the interests of the moment. And if we indulge in philosophising or theorising, part of the pleasure we derive from our efforts is undoubtedly due to the fact that these are activities which have for their main purpose the classification of experiences in accordance with the needs of the individual or the race.

CHAPTER III

THE GROWTH OF THE CONSCIOUS SELF

The Habit and the Complex

We have defined a configuration as a group of engram-sets which tends to ecphore as a whole when a stimulus is acting on part of it. Thus the configuration for "newspaper" enables us to call to mind various papers that we know, and at least some of the characteristics which are common to all papers. But we only do this when there is some purpose in it. It is, for instance, possible to pass a paper-shop day after day without even being aware of its existence, and yet to be, as it were, "pulled up" by it when we happen to be in need of an extra paper. It is clear that the configuration for "paper-shop" ecphores under these conditions because it forms part of a larger system, which contains, among other things, a desire to buy a paper, and that the shop would once again have been passed unnoticed if its configuration had not been ready to ecphore.

In order to be in that state of tension in which the stimulus can ecphore it, a configuration must always contain inborn elements from the urge to

live, for ecphory only takes place in response to some need of the self, and every need which we experience arises ultimately from the urge to live. The two inborn mechanisms by which the urge to live attains its ends are, as we have seen, the reflex and the impulse. When the only inborn elements within a configuration are reflexes, ecphory within it tends to produce some kind of mechanical behaviour, such as the handling of a familiar tool or the effortless reproduction of a known list of words. When the inborn elements are impulses, ecphory within the configuration tends to produce a striving to attain an end, say to climb a wall or to solve a problem. In the former case we call the configuration a habit, in the latter a complex.[1]

It is characteristic of the habit that it functions without the control, and at times even without the awareness of the conscious self. In fact, once a habit is well established, conscious control is more likely to hinder than to help if anyone doubts this, he should try to walk up a flight of stairs with careful attention to every movement. Thus a habit ecphores like a reflex whenever the right stimulus occurs. It is in fact a chain of reflexes, but it is a chain which has been constructed artificially. Moreover, since all behaviour is guided by the urge to live, every habit must have been acquired in response to some need, that is to say,

[1] Cf. below for conscious and unconscious complexes, and the conscious and unconscious needs to which they give rise

it must at its inception have formed part of the system of a complex for which it had some kind of survival value.

The term complex includes a number of familiar experiences. When the configuration centres round a personal relationship, we think of it as a friendship or the reverse; when it centres round a favourite pursuit, as a hobby or an interest; when it centres round part of our philosophy of life, as a principle, an ideal, or a belief.

What complexes we form depends on our environment. The burnt child dreads the fire, the spoilt child expects to be the centre of attention. Complexes would seem to be nature's means of directing impulsive activity into the channels that are most likely to make for survival. Without some such mechanism the impulse would in fact be too dangerous a tool. Thus the impulse to hold one's own in the face of obstacles would inevitably lead to disaster, if there were no means of learning when to fight and when to give way. As it is, every experience forms a complex which has a more or less permanent effect on behaviour. To take a definite instance. If a child struggles with an obstacle and overcomes it, the reappearance of that obstacle on another occasion will ecphore his impulse to fight, but it will not ecphore his impulse to avoid danger. He will, therefore, attack the obstacle more confidently than the first time, and will in all probability overcome it again. And

if that obstacle forms part of his regular environment—if it is, say, a school subject he finds difficult to master—he will presently assume that it is not beyond his power, and will consequently tackle it with the conviction that he can conquer it. What has happened in such a case is that experience has caused the obstacle to become the centre of a configuration which tends to ecphore the impulse to fight at the expense of all other impulses. Similarly, if the child fails the first time, especially if he hurts himself in the process, the reappearance of the obstacle will ecphore both the impulse to fight and the impulse to avoid danger, and it will then depend on subsequent experience how these impulses actually become organised within the complex of which the obstacle is the centre.

As will be shown presently, the individual who has acquired the power of looking before and after, has complexes of which he can become aware, and others of which he cannot become aware. It is usual to call the former *conscious complexes*,[1] the latter *unconscious complexes*.

At first the growth of complexes necessarily involves the direct incorporation of elements from the primary urge to live. The child probably

[1] Shand and McDougall after him use the term "sentiment" for what is now more frequently called a conscious complex. I have adopted the newer term here, because the word "sentiment" seems to emphasise the emotional element, whereas the vital part of the complex, as I see it, is rather its effect on action.

learns to love his bottle, and to fear the angry voice under the direct stimulus of self-preservation. This tendency must, however, decrease rapidly, once the common experiences of everyday life have been classified to the satisfaction of the individual; for the inborn tendency to interpret the new in terms of the old will cause the new engram-sets to become derivatives of previously established sets whenever such are available. If a child is afraid of dogs he will tend to dislike anyone who teases him about his fear, and that dislike may in turn prejudice him against the book which that person gives him—a book which he would have accepted joyfully from anyone else.

It is needless to labour the point. What has been said is sufficient to show how intricate must be the systems of complexes, which grow up in the course of years under the influence of experience.

The Conscious Complex

When a conscious complex is being ecphored, the individual is aware of a desire connected with it, and of interest in the stimulus. He may also experience some form of emotion, and may or may not have to make an effort to attend to the stimulus.

These are mental phenomena with which everyone is familiar from his own experience.

In what follows I propose to show their relation to the process of ecphory.

Desire and Emotion

Since a complex always contains impulses within its configuration, ecphory within it always lead to a striving or " conation " of some kind. When this striving can be satisfied immediately, we are hardly aware of it. As often as not all we know is that we are doing the thing we want to be doing. But when the end of the complex cannot be attained without a struggle, we are liable to become aware of it as a desire. And the greater the blockage the stronger that desire is likely to become, for the end is the end of an impulse which has become incorporated within the configuration, and an impulse has behind it the driving force of the urge to live. If I want to solve a problem and believe that I know how to do it, I am aware of little except the work which it will involve. But if I try and fail, I may become aware of a definite desire to solve it, and further failure may, if the need is great, only increase the strength of that desire.

However, another thing is liable to happen as well. Instead of producing a determination to conquer, failure to attain a desire often produces an emotional outburst as well. There are times when the worker hurls his task from him in a rage and turns his attention to something which gives more scope to his love of power.

However, if the task seems hopeless, or if it does

not seem sufficiently worth while, the energy which is being set free by the stimulus is driven into channels through which it can at least find an outlet, though not an outlet which will enable the complex to attain its end. This path is the path of emotion. It is important to the well-being of the self, because it provides a safety valve for energy, which might otherwise produce dangerous states of tension. But just because it relieves pressure, it also weakens the desire which is being blocked, for it necessarily lessens the amount of energy which can be used in action.

To sum up If a stimulus ecphores a complex, it sets free energy within the configuration of that complex. What path that energy will take, and consequently what end the self will seek to attain, will depend on the way in which the impulses have become incorporated within the configuration. In its efforts to attain that end, the self may meet with varying degrees of difficulty. If the means are obvious, there may be little or no awareness of the whole process. If the task of finding them seems difficult, but not impossible, the resulting blockage may produce awareness of the corresponding desire. If the task seems hopeless and the end important, the blockage may produce an emotional outburst which relieves the internal state of tension, and thereby weakens or destroys the desire. Finally, the stimulus may of course produce a combination of desire and emotion—more particularly when the

attainment of the end is vital to the welfare of the self.

Interest

If an emotional outburst gains the upper hand, it usually absorbs consciousness to the exclusion of all else. If it does not, we become aware of another phenomenon, with which everyone is familiar, namely—interest in the event which is functioning as stimulus.

Observation shows that interest is always directed towards an occurrence or an idea which affects the welfare of the self in some way. I am interested in the stream of traffic when I want to cross the road; I may also be interested in it in a more permanent way, if I am studying problems connected with its increase. In the former case I shall probably only notice it at the moment when it checks my progress, and forget all about it as soon as I am safely across the road. In the latter I am likely to notice it, whenever the work I am doing is uppermost in my mind, and shall probably use my observations as further material for the solution of my problems. But in this case too, once the problems have passed from my mind, my interest in the various blockages will disappear, and I shall only notice them when I am actually on the point of crossing the road. In other words, a stimulus-set arouses interest whilst it is being studied or classified in relation to a particular need, that is to say, whilst

its engrams are being incorporated within the complex which it is ecphoring. Once it is "understood," interest is replaced by behaviour of some kind.

It should be noticed that interest and emotion are totally distinct phenomena. Interest is the feeling tone which accompanies every conscious adaptation to environment, whereas emotion only occurs when the stimulus releases so much energy, that some of it is driven to find outlets whose only value is that they relieve the tension within the system, e g. palpitation, flushing, ejaculation, and the helpless clenching of fists. Interest is keenest when the self is concentrating all its energy on the solution of the problem, whereas emotion is strongest when the self feels helplessly at the mercy of its environment.

Interest may of course be toned with emotion: we may be interested and angry, interested and frightened. This is liable to happen whenever a stimulus ecphores two incompatible complexes. A student of animal behaviour may, for instance, be divided between his desire to stay where he is in order to watch a lioness at play with her cubs, and his fear that she may attack him, if he does not find a safer spot. In such a case the lioness would act as a stimulus for his interest in animals and his impulse to avoid danger. He can, therefore, only make his observations by preventing the impulse from expressing itself in action, and when that is

done, some of the energy usually overflows in the form of emotion.

Finally, interest should be distinguished from curiosity. Interest is, as we have seen, the feeling tone which is produced when a stimulus-set ecphores a complex, that is to say, when it responds to some stirring of that complex. Curiosity, on the other hand, is the emotion which is produced when an unfamiliar object ecphores the impulses to classify. Thus the student of animal behaviour would experience true interest in the play of the lioness, whereas the traveller who knows nothing about animals would experience what should technically be called "curiosity"—the reason being that the play ecphores a complex in the student, an impulse in the traveller.

The impulse to classify may be ecphored by any new experience which does not stimulate the impulse to avoid danger, and its blockage invariably produces curiosity. It seems to be nature's way of enabling us to accumulate information about our environment before we actually need it. In childhood, curiosity is a common experience, partly because there is so much that is new, partly because there are as yet so few fixed interests. But as organisation proceeds, new experiences tend more and more to have sufficient familiar elements to be able to ecphore a complex of some kind, with the result that pure curiosity is experienced more and more rarely. All the same, objects that are abso-

lutely strange continue to hold our attention throughout life, and the impulse to classify is so strong, that it is very difficult to put them aside until we have found some kind of meaning for them. Like all true emotions, curiosity is strongest when the impulse is being blocked and disappears rapidly when its end has been attained.

Attention

Attention is another phenomenon with which everyone is familiar. In its original meaning it seems to suggest a state of strain or effort. We speak of "bending our minds" to the task, of concentrating upon it. Yet attention is closely connected with interest, for we attend to the things that interest us, and to those alone. Attention must, therefore, also result from ecphory. But while interest is present whenever a stimulus is being incorporated within a system, attention is not. In fact, when we are thoroughly interested in a task, we are not aware of any bending or straining or concentrating. We are just absorbed in it. On the other hand, true attention always means effort, and introspection shows that this effort is always due to conflict between incompatible desires. In other words, we bend our minds to a task when there is something else which we would prefer to do instead. It may be that we are being compelled to make the effort by someone who is too strong to

be resisted. It may be—and ideally always should be—that we feel it to be worth our while to make the sacrifice for the sake of the benefit we shall derive from it in the future. In short, attention is the mental state of which we become aware when the environment ecphores incompatible complexes, of which neither is strong enough to block the other completely. How much effort is needed obviously depends on the relative strength of those complexes. There are times when it seems impossible to concentrate on the chosen task, because its rival is continually forcing itself upon consciousness; there are times when a vigorous effort at the beginning is sufficient to block the other long enough to enable the self to complete the task without interruption from it.

When a stimulus only ecphores one conscious complex, it may absorb us to the exclusion of all else. In extreme cases we no longer hear what is going on around us, and we simply "forget" anything that might distract us. But anyone who knows what it means to be thoroughly absorbed in a task, knows that all this is involuntary. He does not consciously ignore the request of his companion, or put aside the tiresome engagement. He just thinks of his problem to the exclusion of all else. In terms of the engram theory, the predominant system is blocking all others in such a way that they cannot produce conscious awareness. This is liable to happen whenever a stimulus ecphores a

strong complex. For the time being that complex is the only effective part of the conscious self, and its end can therefore be attained with the minimum effort. In other words, a strong complex tends to affect behaviour as though it were an isolated whole, and could consequently satisfy its desires, without affecting other needs of the self. Since this is achieved by blocking ecphory within rival complexes, I shall refer to this tendency as the Law of Mutual Blockage. Its importance will become apparent as we proceed.

Notes on Attention

Note 1.—The term attention is often used in a wider sense than the one which I have given it in the text. Ward defines it as the state of being mentally active enough to receive impressions.[1] This would include awareness of a sudden noise as well as purposeful concentration on a problem. Others would exclude awareness, but include absorption. It is only a matter of terms, but it seems to me that it is perhaps clearer to describe the three mental states by three different terms—attention, when there is more or less conscious blocking of a rival complex; absorption, when the predominant complex is ecphoring freely; awareness, when a stimulus ecphores a rival complex or a reflex in such a way that it blocks the flow of thought

[1] *Encycl Brit*

sufficiently to force its existence upon the conscious self.

Note 2.—In his *Physiological Psychology*, Prof. McDougall suggests that concentration on one activity leads to the diversion of the whole stream of energy into the channel of that activity. This means in practice that the energy which is set free by rival stimuli is used to swell the amount which is available for the main activity. If this is the case it is difficult to account for the blockage between different systems of the self—a blockage which can only be removed by ecphoring the systems simultaneously. And since the study of unconscious complexes has now accustomed us to the idea that complexes do as a matter of fact "store" energy within their systems, it seems simpler to assume that this is what happens when the predominating complex is blocking the ecphory of its rivals.

The Organisation of Complexes

So long as life is very simple, whole-hearted concentration on the task in hand undoubtedly makes for survival, for it enables the individual to use all his resources in the solution of his problem. But even the little child soon finds that he can rarely afford to treat even a strong desire as though it were his only one.

A boy of four or five is, for instance, quite capable of choosing a window-sill as a target for his ball without thinking of what may happen if he misses

his aim. What he needs is a mark which is easily seen, and as this is his dominant need, it alone decides what engrams the window-sill is able to ecphore. Somewhere at the back of his mind he knows quite well that there is a glass window above the sill, but the fact does not become conscious, because it does not help him to attain the end of the moment. It is only when the ball crashes through the window that the boy realises what he has done. Then the system connected with "mischief" begins to ecphore, and the sudden change from the window-sill as "target" to window-sill as "below breakable window" causes a link to be formed between them, so that they hereafter tend to ecphore together. If the result was sufficiently startling the boy will not aim his ball at a window-sill again, without realising the risk he is taking, because the sill will now remind him of the glass in the window above it as well as of the fact that it makes an excellent target. He will, however, be guilty of many another thoughtless act before all the necessary links have been formed, for these links only appear gradually under the influence of experience, and the Law of Mutual Blockage continues to isolate individual systems or groups of systems, except in so far as they have coalesced under the influence of experience.

As the groups began to develop, the individual presently finds that a stimulus-set rouses two or more conflicting complexes. It is then that he is

forced to think before he acts. And when this stage is reached, we notice that his behaviour begins to show foresight and consideration. If the environment is favourable [1] the organisation of systems into groups soon begins to be supplemented by the organisation of the groups among themselves, until there emerges a more or less clearly defined master group to which the majority of systems are linked, either directly or indirectly. Owing to its constitution, this master group tends to be ecphored by most of the stimulus-sets, which the individual, encounters in the course of his daily life. It is, therefore, the source of our power to look before and after, that is to say, of our power to become conscious of our own existence.

The Effect of Community Life

Throughout the process of organisation which I have been describing, it is the need of adaptation which is the driving force, for self-preservation urges each one of us to fit himself into the environment in which he finds himself. The behaviour which this urge produces in a particular case is itself the product of two contrary forces—the primitive egotism of the individual, and his need for companionship. If primitive egotism controlled

[1] We are not here concerned with the factors which make for a favourable environment For a consideration of these the reader is referred to books on the psychology of behaviour, such as the *New Psychology* by Tansley or my own *Education of Behaviour*.

behaviour to the exclusion of all else, it would make us ruthless towards the needs of others, and incapable of appreciating any point of view except our own. In relation to selected individuals the activity of this impulse is checked by the tendencies which make for family life and friendship; in relation to the community at large by the tendency which is usually called gregariousness, that is to say, the need for companionship as distinct from friendship. Thus true adaptation involves behaviour which satisfies both the egotism of the self and its need for companionship.

In practice this means that the individual soon learns that he must control his desire to have his own way in everything, if he wants other people to put up with him. And though his egotism rebels against submission, his need for companionship is so great that he always gives way sooner or later. But the result is a feeling of inferiority, which produces a craving to attract the attention of others, as well as a more or less serious lack of confidence in the value of his own efforts. It is not only the child who begs us to "come and see," and who asks one person after another to admire his work. The adult uses different means, but his purpose is often the same. In fact most people find that half the pleasure is lost if a new acquisition or a new discovery cannot be shown to others.[1]

[1] It may be this is the reason why some people find it so difficult to keep a secret.

There is, however, another side of the question. If the need for companionship forces subordination upon the individual, it also makes leadership possible, and as a rule it does not take a child long to discover that every successful display of power may win him disciples. Every leadership which is acquired, necessarily decreases the feeling of inferiority by providing an outlet for the primitive egotism. Thus the average person manages to compensate in part for the submission which his gregariousness exacts from him by becoming the leader of one or more groups.

Even so the primitive egotism is responsible for continual friction in the daily life of the community. The more vigorous the individual, the more liable is he to misjudge the actions of a leader, or to underestimate the ability of an equal. And though community ties are usually strong enough to prevent open rebellion, there can be no question that egotism causes an immense amount of more or less conscious discontent in the rank and file of every group. In fact it would probably render all the more complex and organised forms of social life impossible, if it were not for the fact that Nature has endowed us with another tendency which enables us to satisfy both our gregariousness and our egotism by identifying ourselves in thought with the people whom we would otherwise envy. It is thanks to this *mechanism of identification* that we are able to think of our leader as part of ourselves,

with the result that we can enjoy his victories as though they were our own. And at times this process of self-deception is so successful, that we do actually "live" the life of another, and so achieve in imagination what we could not even attempt in reality.

The imitative play of children offers a good instance of this type of self-expression. Left to themselves children will often play at being parent or teacher, giant or fairy, but their intention is clearly not to reproduce what they have seen or heard, for they only choose scenes which suggest the power of the person they are representing.[1] The impression one derives from this kind of play is, in fact, that the child is finding an outlet for his egotism by identifying himself with the people whose greater power he has cause to envy. (It is perhaps hardly necessary to add once more that the child is not aware of this. All he realises is that he enjoys his play.) The adult also indulges in play of this kind. When he becomes absorbed in a novel or a play, he is for the time being the hero of the plot, and enjoys in phantasy the adventures which reality denied him. When he watches a match without much knowledge of the game, he has for the time being the skill which he has never had the

[1] A neurotic, bad-tempered mother once said to me: "I really must learn to control myself with A [her little daughter] She was playing at being mother the other day, and it gave me a shock to see her."

perseverance or the opportunity to acquire. If he is interested in the technique of the game or the novel without any desire to learn from what he perceives, he is probably enjoying the sense of power which he derives from at least understanding what he knows quite well he could never produce.

To sum up: Our infantile love of power is so great that it would rest content with nothing less than the mastery of the whole world, if it were allowed free play. We are, however, seldom aware of it in its full strength, because it is always being blocked by our gregarious tendencies, even when there are no ties of friendship or of personal dependence. Moreover, the conscious self is essentially the community self, and it therefore resents undue egotism as a threat to its well-being. This continual blockage tends to produce a feeling of inferiority in every member of a community. If conditions are normal, that feeling is, however, kept within reasonable limits by (1) the mechanism of identification which enables each individual to become a leader by proxy and (2) the opportunity of becoming the real leader of this or that section of the community.

The Unconscious Complex

As I pointed out earlier in this chapter, the little child is at first entirely self-centred: he loves those who take notice of him, he hates those who refuse to give him what he wants. Moreover, owing to

the Law of Mutual Blockage, he is liable to form contrary complexes without being aware of their incompatibility. He loves the mother who plays with him, he hates the mother who takes him out of his bath, and in neither case is his feeling influenced by the recall of other occasions. Presently he discovers that some of his attitudes meet with approval, others with disapproval, and since he is, as we have seen, very dependent on the opinion of others, he assumes that those which meet with disapproval must be wrong, if not actually "wicked." Sometimes he projects them on imaginary companions, but anyway he feels that they cannot be part of himself, because it would hurt his egotism to have to believe that he was not as good as others. A little later they are usually forgotten entirely.

Thanks to psycho-analysis we now know that, though forgotten, the anti-social complexes which are formed in early childhood have for that reason not ceased to exist. What has happened is that they have not become organised into any of the systems of the conscious self, and are therefore incapable of making the individual aware of their existence. Analysis has shown that they continue to ecphore under the influence of suitable stimuli, and that they form derivatives and become associated into groups, just like conscious complexes. But they are not part of the system of the conscious self, and are therefore always unconscious.

We are thus led to ask what happens to the energy

which is set free within such a system when it is ecphored by a suitable stimulus-set. It appears that one of two things may happen: the energy may accumulate within the system, being kept there by energy from the conscious self, or it may find an outlet through a complex which is derived from the original desire in some way or other, and is yet of such a nature that it does not interfere with the desires of the conscious self, and is therefore not blocked by it. Of these the former is necessarily harmful, for it keeps the system isolated from the rest and does this by means of energy, which could otherwise have been used in the attainment of conscious ends.

It is perhaps worth while to point out that the process of blockage is always unconscious. The individual only becomes conscious of what is not blocked. We only know that energy must have been used in this way, because the removal of a blockage always leads to an increase of the amount which is at the disposal of the conscious self.[1]

Whether the latter is harmful or not depends on the outlet which the energy finds. It may be a form of expression which definitely increases the efficiency of the conscious self, it may be a neurotic symptom or merely a harmless "fad" or mannerism. Infantile jealousy of a brother may, for instance, become conscious as an intense desire to excel him,

[1] For a fuller discussion of this subject the reader is referred to the books on psycho-analysis which are given in the bibliography.

a desire which may lead to hard work and self-control, if it is handled wisely. On the other hand it may result in a neurosis which renders the individual incapable of looking after himself, and thus restores to him some measure of the parental care which his unconscious complex desires. Or it may produce nothing more serious than a rather childish insistence on small privileges.

CHAPTER IV

THOUGHT AND THINKING

THOUGHT and thinking are terms with which everyone is familiar. We say that we are thinking when ideas are passing through our mind, and we call the ideas of which we become aware within ourselves our thoughts.

Thinking in this, the most obvious sense of the word, appears to be coextensive with consciousness. Our ordinary daily acts are only conscious in so far as they are accompanied by thoughts, our outbursts of emotion are accompanied by a flow of images and words, which give them their meaning, and the moods for which we cannot account lead us to wonder why we are indulging in them, if indeed they do not drive us to invent suitable reasons.

Observation shows that we are liable to two kinds of thinking, that which is initiated by conscious efforts to overcome obstacles in our environment, and that which at first sight seems to serve no useful purpose, but to be at its best a harmless form of play, and at its worst a serious menace to the welfare of the self. It will be convenient to refer to the former as *adaptive thinking*, and to the latter as *phantasy thinking*. Thus adaptive thinking

accompanies all conscious efforts of an individual to hold his own in his environment, whereas phantasy thinking covers such phenomena as dreaming and day-dreaming.

We will begin by considering the origin of adaptive thought.

The first thing to notice is that there must be a minimum of difficulty to produce even a fleeting thought. Many of our reflexes are incapable of producing direct awareness, others only produce it when they are checked, that is to say, when the stimuli set free energy which cannot find its normal outlet, others only produce it after the reaction has taken place.

To the first class belong the reflexes of the digestive system, whose very existence we do not suspect, unless we study physiology. To the second class belong the reflexes which control our breathing. As is well known, these reflexes do not attract our attention so long as they are functioning normally, but are capable of producing acute discomfort, if we make too great demands on them by running too fast or by climbing too steep a hill. To the third class belong the cough, and the sneeze, which we have failed to control in a crowded lecture-room, and which, thereupon, acts as a stimulus set to a number of conscious complexes. In all these cases there is only awareness when there is difficulty. So long as the energy can take its accustomed path, and so long as the resulting impulsion does not

produce an unusual or undesirable effect, reflex processes can go on year after year without forcing themselves upon our notice.

A voluntary act is accompanied by awareness, whilst it presents difficulty, but the intensity of the awareness decreases as the act becomes more familiar, and a habitual act is often quite as mechanical as a reflex.

To take a definite instance:

The little child who is learning to write has to think about the form of every letter: he may not be sure which way the *d* should face (i.e. *d* or *b*), he may not know whether the stroke for the *g* should be above or below the line. But to the adult these things are obvious. Whilst his mind is occupied with the idea he is trying to express, he does not give the actual letters a thought. They present no obstacles, and consequently produce no awareness. But when that same adult is trying to read the handwriting of another, he may, on the contrary, become very clearly aware of the forms he has to decipher, and may find that at least some of the mysterious symbols, which he has before him, suggest quite a number of possible groups of letters from which he then has to choose the one which seems the most likely from the context in which the symbol occurs. In terms of the engram theory the difficulty which is experienced in deciphering an illegible script is due to the fact that the symbols ecphore two or more engram-sets, and, therefore, suggest two or

more meanings, whereas a conventional form only ecphores one engram-set, and consequently only suggests one meaning. In other words adaptive behaviour only produces thought when there is a difficulty to overcome, that is to say, when the stimulus-set ecphores two or more engram-sets, which produce impulsions that interfere with each other, whereas there is no awareness, and consequently no thinking, when the stimulus-set ecphores only one engram-set or when it ecphores sets whose impulsions reinforce each other in such a way that the act follows upon the stimulus without encountering obstacles.

As everyone knows, the thoughts which actually occur in adaptive thinking are, in so far as they are relevant,[1] thoughts of what we might do with reasons for or against each alternative of which we become aware.

This suggests that one of the functions of adaptive thought is to act as a sort of safety valve, which makes it possible for us to block our impulsions at least temporarily. Hence, its function is in part similar to that of emotion, which is, as we saw in Chapter II, a means of relieving tension when more energy is set free by the stimulus-set than can be used in action. But the process of which we become aware as thought has far higher adaptive

[1] Introspection shows that there are usually also side thoughts which do not aid in the solution of the problem. As will be shown later, these are due to the activity of rival complexes.

value. In an emotional overflow the surplus energy is side-tracked and wasted, it is prevented from doing harm, but it is not turned to any useful purpose. In the act of thinking the energy is, on the contrary, used to ecphore complexes, which are linked to the one which is being stimulated, and is thus used to add to the efficiency of the individual. In a difficult situation we usually become aware of both emotion and thought, but, as is well known, it is the person who can keep his head and think who is most likely to extricate himself successfully: the reason being that he can use his previous experience to aid him in his efforts, whereas the person who dissipates his surplus energy in emotion is dependent on the engram-sets, which are actually being ecphored by the stimulus-set, and is consequently less likely to hit on the best form of behaviour, if conditions are the same in other respects.

When we think about a desire, without attempting to realise it in action, we usually become aware of reasons for and against it, the reasons for being suggested by the complex whose impulsions are being blocked, the reasons against by the complexes which are responsible for the blocking. I may want to go to a concert, because the programme appeals to me, or because I want to hear the new violinist. I may hesitate about going, because I am behindhand with my work, or because there is something else which I ought to be doing that evening. And until I have made up my mind, I

shall either discover new reasons on one side or other, or else find myself restating to myself the reasons of which I am already fully aware. Clearly all these reasons are due to ecphory of previously established engram-sets. Hence impulsions which are blocked cause ecphory within the complexes to which they owe their existence, and this ecphory is in some way rendered conscious in a form which we call "thought."

In short the blocking of an impulsion produces ecphory within the complex to which the impulsion belongs, and this ecphory tends to affect the conscious self in such a way as to make it aware of the impulsion as a desire, and of engram-sets within the configuration as reasons for indulging that desire.

We may sum this up as follows:

When an impulsion of a conscious complex is blocked, part of the energy is side-tracked to inborn engram-sets, which are connected with the activity of the heart, lungs, glands, etc. Ecphory within these produces a form of conscious experience, which we are accustomed to call "emotion." The rest of the energy ecphores other members of the group to which that complex belongs, thereby producing another form of conscious experience, which we are accustomed to call "thought." Moreover, if the energy which is being blocked ecphores impulsions within other engram-sets, the thoughts of which we become aware are thoughts of the corresponding forms of activity; if it ecphores

other elements, such as the qualities of the object, the thoughts of which we became aware are reasons for or against that activity.[1]

As I stated in the last chapter, psycho-analysis has shown that the energy which is blocked within an unconscious complex may at times not find any outlet at all, but in so far as it does escape without finding expression in action, it too must take the path of emotion or thought. The emotional outlets it finds include the moods and emotional outbursts for which there seems to be no sufficient cause in the actual environment of the individual. The thoughts are the dreams and day-dreams which are, as we shall see, substitutes for forms of behaviour which the conscious self has repressed and suppressed as undesirable. Thus phantasy thoughts are like adaptive thoughts, more or less unsatisfactory safety valves for the complexes to which they owe their origin.

In so far as these phantasy thoughts concern desires of which the conscious self does not feel ashamed though it realises that they cannot be satisfied in reality, they are at least able to produce awareness of themselves in their original form. Thoughts of this nature form the material of many of our day-dreams, more particularly of the "castles in the air" in the building of which many of us take so much pleasure.

But when phantasy thoughts concern desires

[1] Cf below Chapter XV.

which have become repressed as anti-social, or even at times when they concern desires which the self is trying to suppress for some reason, then the impulsions cannot produce awareness of themselves in their original form, and have therefore to express themselves through another desire which in some way stands for them.

For a detailed examination of the growth of phantasy thoughts and of the part which they play in the life of the individual, the reader is referred to books on that subject—more particularly to Freud's *Interpretation of Dreams*. All I shall attempt here is to indicate the line of thought by giving part of the analysis of a dream :

Winnie (aged 12½) came from a home in which all discussions of sex questions were tabooed. At the same time an aunt with whom she spent much of her spare time had just had her first child. In answer to my questions she told me she knew nothing about reproduction, and true to her home training declared she did not want to know anything about it. Here is the dream as she gave it : "A little boy is sitting at a table, working out a sum or a problem of some kind. He is looking very puzzled. He is all alone in the room." I asked her what the boy was like. She said, "He is about 12 years old, he is *very* thin. No, he doesn't look ill, he has nice red cheeks. He is working a sum, I think ; he is looking very puzzled." When I asked her what the table was like, she told me it was the card table

at her grandmother's house, "opened out so that the green shows," adding, "I like to open it." This card table had figured in an earlier dream (the actual interval was nine days) when it had suggested the fact that her parents often played cards at night, but that she was always sent to bed just when the game began to be exciting. I had then asked her: Can you play cards? and had been told quite indignantly, "Of course I can, I have watched them so often."

We may take it, then, that the card table stands for the thing which her parents know, but which they continue to withhold from her, though she would like to be told, and feels sure she is quite old enough to understand. The very thin little boy shows the particular problem which is worrying her at the moment, and the extent to which she has solved it. It is evidently the part played by the father that she does not understand, she knows his function is not that of the mother, but she does not know what it is. Moreover, the boy would seem to be a composite figure, for his age, his occupation, and the fact that he is quite alone in the room (i.e. with no one to help him) all suggest that he represents herself as well as her problem.

Thus Winnie finds in her dream a means of telling me that she does want to know very badly about the mysteries which surround parenthood, although she had only two days before definitely declared that she was not in the least interested,

and did not want to know. In other words the dream acted as a safety valve for a desire which her home training had taught her to consider thoroughly wicked. The desire was expressed symbolically in the card table and the thin little boy, and it was allowed to become conscious just because it was disguised so well that the conscious self did not recognise it.

In order to give an idea of the way in which the conscious thought is evolved in such a case, I will next try to show the use to which the table was put in the dream.

The table was, as we have seen, a card table which Winnie liked to open. Moreover, both her parents and her grandmother played cards, whereas she was only allowed to look on, though she was anxious to play and sure she could do it. Card-playing was, therefore, another forbidden occupation. It was, moreover, another thing of which she was always only allowed to see the beginning; besides, she had not actually tried to play cards, though she thought she could. For some or all of these reasons the dream only gives the open card table. She is allowed to open the table, and she likes doing it. Moreover, it is a necessary preliminary to the card-playing which in turn stands for sex instruction. Thus the harmless open table represents the forbidden sex instruction.[1]

[1] There was probably another deeper meaning in the open table, but that does not concern us here.

The connection between the card table and the desire for knowledge is shown in the diagram which is given below. The radiating lines are intended to indicate that each complex is linked to a number of others, and a line between two complexes that these two have become linked together under the influence of previous experience.

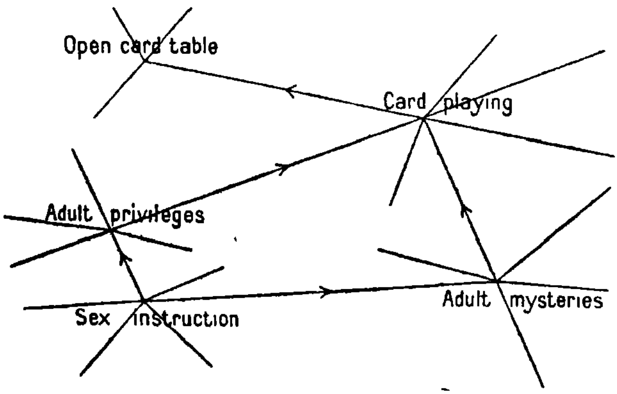


FIG. 2.

We are here faced with something which is just like adaptive thought, except that it does not become conscious. The girl refused sex instruction when it was offered her, and the impulsion which the offer produced passed by means of common links through card-playing to the open card table before it became conscious. It is therefore a case of ecphory under the influence of a blocked impulsion, and the process is just like that which we studied in adaptive thought except that it

does not become conscious. It will, therefore, be convenient to call it unconscious thought. Thus *thought may be defined as ecphory, which is produced under the influence of a blocked impulsion. It is conscious if the ecphory produces awareness of itself within the conscious self, unconscious if it does not.*

Since it is impossible for the conscious self to become aware of unconscious thoughts, we do not, as a rule, realise how large a part they actually play in our ordinary life. But every now and then something happens, which makes us wonder how far we are aware of what goes on within us. We find that the fact which we have vainly tried to recall suddenly comes to mind "of its own accord," after we have given it up as hopeless, and that the solution of a difficult problem "strikes" us hours or even days after we left it in despair. Then, again, we come across cases such as that of an engineer, who woke up in the middle of the night, feeling convinced that one of his machines needed overhauling, and thereby averted a serious accident. And we have most of us had "premonitions" which certainly seemed to come "from nowhere" at the time, even if we could afterwards account for them in terms of stimulus-sets which were sufficient to cause the necessary ecphory, though they failed to produce conscious awareness. In all these instances the process has evidently been similar to that which produced the image of the table in the dream which we have been discussing. It is a process of more or

less elaborate unconscious thinking, of which only the end-result becomes conscious.

When the ideas which it produces happen to be of value to the conscious self, they are often called "intuitions." This term is, however, used in so many different senses, both in scientific and in popular literature, that it seems better to avoid it in psychological discussions. Observation shows that unconscious thought plays an important part in all original work. If the reader will note down his line of thought after he has solved a problem which did not yield to customary forms of attack, he will find *that his new ideas seemed to appear full fledged from the unconscious and that the conscious self confined itself to the work of testing each idea as it became conscious.*

Sometimes the ideas of which we become aware appear before us as naked items, at others as clothed wholes. Which form they take must depend in part on the impulsions to which they owe their existence: the worker who has set himself the task of finding a solution for a consciously realised problem has already projected his unconscious complex into that problem, and can, therefore, proceed in the work without hiding the steps from himself. Besides, it is necessary for him to test each idea as it occurs, and it is therefore to his advantage to become aware of his ideas in as unadorned a form as possible.

But the person who is engaged in literary work

is concerned with the symbolic expression of complexes of which his conscious self cannot become aware. The several items matter little to him; what he wants is a picture or an impression, which will convey to others what he is feeling himself. And it is probably just because he cannot become aware of the ultimate source of that feeling, that he is likely to be more successful, if he can do the whole of the work by means of unconscious thinking. However that may be, poets seem to agree in thinking that "real" literary work is done without conscious effort. They feel compelled to write, they do not know what is coming, and have to read it through afterwards to see what it is about. They may dream it like Stevenson or believe it is dictated to them like Blake.[1]

Moreover, the worker who tries to use his art to teach ethics or philosophy may find to his own bewilderment that the product of his unconscious desires is disproving the very thing which his conscious self was intending to demonstrate. We have an interesting example of this in Wagner's description of the way in which he composed the poem of the Nibelungen, as given in a letter which he wrote to his friend Roeckel on this subject.[2]

"Nothing is stranger," writes Wagner, "than

[1] Cf *The Poetic Mind*, by F. C Prescott.

[2] Extract from a letter in "What does Wagner tell us about the origin of the Nibelungen Poem?" There is a translation by C de C. Parrish

the way in which the philosophy of life, which became apparent in my poems, was diametrically opposed to the interpretation of the meaning of Life which I held consciously at the time. The most striking instance of this I was finally to experience in my Nibelungen poem. At the time when I was working at this poem, I believed in a Hellenistic-optimistic world, which could, I thought, be realised in actuality as soon as mankind desired it. . . . I recall now having chosen the Nibelungen myth in order to . . . show that it is our duty to recognise evil (*Unrecht*), to eradicate it, and finally to found a just world in its stead. And I hardly noticed how the execution, and in truth even the delineation, of the plan was unconsciously being guided by another much deeper interpretation . . . with the result that the thing that came to light was quite different from what I had planned. Just once I forced my conscious point of view upon a character. That was when Brunhilde contrasts the only love which brings true joy with the corruptness of possession, but (unfortunately!) without realising that this very love has proved itself thoroughly destructive in the course of the myth. So blind did my conscious purpose make me at this point. Strangely enough this passage worried me continually, and it was not till Schopenhauer finally brought about an absolute revolution in my philosophy of life that I realised the cause of my distress."

Obviously real poetry is not necessarily good poetry. Poetry is real, if it is the expression of something which is vital to the author. Robert Graves in his delightful essay *On English Poetry* makes a careful distinction between real poetry and what he calls fake poetry. He says: "As in household economics, you cannot take out of a stocking more than has been put in, so in poetry, you cannot present suffering or romance beyond your own experience. The attempt to do this is one of the chief symptoms of the fake poet; ignorance forces him to draw on the experience of a real poet, who actually has been through the emotional crises which he himself wants to restate. . . . There is a great deal of difference between fake poetry and ordinary bad poetry. The bad poet is likely to have suffered and felt joy as deeply as the poet reckoned first class, but he has not somehow been given the power of translating experience into images and emblems, or of melting words in the furnace of his mind and making them flow into the channels prepared to take them."

The same writer also gives an interesting account of the ideas which went to the making of one of his own poems, and of the way in which he wrote it.

I quote the passage in full. As the reader will see, this analysis includes no attempt to look for unconscious sources, but even the conscious material gives associations which no one would suspect from the poem itself, and of which the author was not aware himself until he, as it were, turned his mind upon himself.

"THE GOD CALLED POETRY

"A piece with this title which appeared in my *Country Sentiment* was the first impulse to more than one of the main contentions in this book[1] and at the same time supplies perhaps the clearest example I can give of the thought-machinery that with greater luck and cunning may produce something like Poetry. I wrote it without being able to explain exactly what it was all about, but I had a vision in my mind of the God of Poetry having two heads like Janus, one savage, scowling, and horrible, the face of Blackbeard the Pirate, the other mild and gracious, that of John the Evangelist. Without realising the full implication of the symbolism, I wrote:

> Then speaking from his double head
> The glorious fearful monster said,
> 'I am Yes and I am No,
> Black as pitch and white as snow,
> Love me, hate me, reconcile,
> Hate with love, perfect with vile,

[1] I.e. *On English Poetry*.

So equal justice shall be done
And life shared between moon and sun.
Nature for you shall curse or smile ;
A poet you shall be, my son '

"The poem, so far as I can remember, was set going by the sight of . . . a guard of honour drilling on the barrack-square of a camp near Liverpool! I was standing at the door of the Courts-Martial room, where I was shortly to attend at the trial of a deserter (under the Military Service Act) who had unsuccessfully pleaded conscientious objection before a tribunal, and had been in hiding for some weeks before being arrested. Now, I had been long pondering about certain paradoxical aspects of Poetry and, particularly, contrasting the roaring genius of Christopher Marlowe with that of his gentle contemporary Shakespeare; so, standing there watching the ceremonial drill, I fancifully made the officer in command of the guard, a young terror from Sandhurst, into a Marlowe strutting, ranting, shouting, and cursing—but making the men move; then I imagined Shakespeare in his place. Shakespeare would never have done to command a guard of honour, and they would have hated him at Camberley or Chelsea. He would have been like a brother-officer who was with me a few weeks before in this extremely 'regimental' camp; he hated all the 'sergeant-major business,' and used sometimes on this barrack square to be laughing so much at the absurd pomposity of the

drill, as hardly to be able to control his word of command. I had more than once seen him going out, beltless, but with a pipe and a dog, for a pleasant walk in the country, when he should really have been on parade. In France, however, this officer was astonishing: the men would do anything for him, and his fighting feats had already earned him the name of Mad Jack in a shock-division, where military fame was as fugitive as life. This brother-officer, it is to be noted, was a poet, and had a violent feeling against the Military Service Act. I wondered how he would behave if he were in my place, sitting on the Court-Martial; or how would Shakespeare? Marlowe, of course, would thunder 'two years' at the accused with enormous relish, investing the cause of militarism with a magnificent poetry. But Shakespeare, or 'Mad Jack'?

"That night in the quarters which I had once shared with 'Mad Jack' I began writing:

> I begin to know at last,
> These nights when I sit down to rhyme,
> The form and measure of that vast
> God we call Poetry . . .
>
> . . . I see he has two heads
> Like Janus, calm, benignant this,
> That grim and scowling. His beard spreads
> From chin to chin; this God has power
> Immeasurable at every hour . . .

The black beard scowls and says to me,
'Human frailty though you be,
Yet shout and crack your whip, be harsh;
They'll obey you in the end,
Hill and field, river and marsh
Shall obey you, hop and skip
At the terrour of your whip,
To your gales of anger bend'

The pale beard smiles and says in turn,
'True, a prize goes to the stern,
But sing and laugh and easily run
Through the wide airs of my plain;
Bathe in my waters, drink my sun,
And draw my creatures with soft song,
They shall follow you along
Graciously, with no doubt or pain.'

Then speaking from his double head, etc.

"The rather scriptural setting of what the pale beard said was probably suggested by the picture I had formed in my mind of the conscientious objector, whom I somehow sympathetically expected to be an earnest Christian, mild and honest, as a matter of fact, he turned out to be the other kind, violent and shifty alternately. He was accordingly sentenced by Major Tamburlaine and Captains Guise and Bajazeth to the customary term of imprisonment."[1]

We return to our discussion of conscious and

[1] *On English Poetry*, pp. 62–65.

unconscious thinking. The reader who has followed the line of thought in this chapter will have realised how vast an amount of our thinking is unconscious. There is the thought which remains unconscious, because it only satisfies unconscious complexes. There is, as in the case of the dream and the poem, the thought which only bursts through from the unconscious when it has acquired a form in which it can give relief to the complexes to which it owes its origin. But even in the solution of a problem in which there is nothing to hide, all the preliminary work goes on below the surface of consciousness, and we only become aware of ideas when they are ready to be accepted or rejected by the conscious self. Thus conscious thought is only part of the process by which we adapt ourselves to our environment, or in the case of phantasy thinking by which we find partial substitutes for what we cannot have in reality. All the preparatory stages are normally unconscious, some can be observed if special attention is paid to the process as such, as in Graves' analysis of the sources of *The God Called Poetry*. Others can be rendered conscious by special methods, such as those of psycho-analysis and hypnosis. But many, more particularly those which end in the construction of a new idea, are, so far as we know, incapable of producing awareness.

CHAPTER V

SOME FORMS OF SELF-EXPRESSION

SELF-EXPRESSION is a term which has been defined in a number of ways. I am using it here somewhat arbitrarily to denote behaviour which satisfies the immediate needs of the self without any regard to the fact that future welfare may depend on present abstinence. Reduced to these narrow limits the needs of the self are freedom from undue internal tension and satisfactory outlets for its primitive egotism.

The internal tension to which the self is exposed is, as we have seen, due to the accumulation of energy within complexes which are being blocked, either by an obstacle in the environment or by the activity of another contrary complex. And the only way to relieve strain is to find a stimulus-set which will ecphore the complex in such a way that its energy can be used in action. Hence the well-being of the self depends to a large extent on the complexes which the individual acquires. If these are organised in such a way that there is a minimum of unnecessary internal strain, and if they give rise to desires the attainment of which increases the individual's feeling of power, then he is likely to

feel that he can express himself freely. If they do not fulfil these conditions, he is, on the contrary, liable to feel unhappy and discontented.

After childhood the complexes of an individual gradually become organised into systems which thereafter govern his behaviour in all the more important situations of his life. The more important of these are the home ties and community ties which he makes in the course of his life, the occupation by which he earns his right to live, his hobbies, his interests, and his beliefs. And, whenever one of these is strong and lasting, it can be shown to be a derivative of a deep-seated complex which is using it as an outlet for surplus energy.

The Choice of a Career

In order to show what this means in practice, I will work out the way in which the choice of a career may be influenced by unconscious as well as conscious motives. Psycho-analysis has shown that a little child who imagines (rightly or wrongly) that he has been deceived by someone he loves about something which he considers very important, may succeed in forgetting all about this injury to his self-esteem, but that the event itself may form an unconscious complex which reappears in adolescence as a desire to know the truth about things, without, of course, the least recollection of the infantile need for which this desire acts as a safety valve. If such a boy comes under the

influence of a stimulating science master, and if other circumstances are favourable (including the absence of contrary complexes), the chances are that he will develop into an enthusiastic student of some branch of science. In another environment this same boy might have become an equally enthusiastic detective, in another he might have made a successful newspaper reporter. The point to notice is that the occupation which the boy has chosen will, in each of these cases, increase his general well-being by providing a legitimate outlet for a complex, which might otherwise have added to his difficulties in life by making him, for instance, abnormally curious about the affairs of other people.

In the case which I have imagined, all has gone well. In others the individual is hampered by some inability within himself. A boy who wants to take a degree at a university may seem to be unable to do himself justice at examinations, or he may find it impossible to acquire the necessary proficiency in some one subject, though his general ability is quite good. Another who wants to become a teacher may find that he cannot face an audience or that he is unable to overcome a tendency to stammer. In such cases a keen desire to persevere suggests that the chosen career is ecphoring fundamental complexes of the self, whereas failure to overcome what should be a minor difficulty suggests the activity of an unconscious complex, which is strong enough to block the con-

scious self. As an instance, I will take the case of a pupil of good average ability, who is unable to reach matriculation standard in some one subject—say mathematics. If the unconscious complex is not too strong, it is possible to help such a pupil through his examination by acquiring sufficient influence over him to be able to create in him a belief in his own powers. I have myself had occasion to do this more than once, and by dint of beginning with the elements of the subject, and planning the work in such a way that the pupils were continually coming across proofs of their own power, I have made it possible for them to pass their examination. But it must not be imagined that I thereby gave them the power to work at mathematics without my help. Removed from my influence they soon became unable to fight their unconscious complex, and were, consequently, before long, once again unable to do the work. To obtain a permanent cure in such a case it would be necessary to deal with the unconscious complex which was the source of the trouble, and in the more serious cases this can only be done by means of a systematic course of psycho-analytical treatment.

The way in which a simple inhibition can sometimes be removed by tracing it to its source will be seen from the following example. B (aged 10 years 11 months) came to me for treatment for stammering. When she had got over her worst difficulties she said to me one day: "I can manage

quite well at school now, but I do find my number hard to say. It is 22, and that is hard to say, isn't it ? much harder than 1." I asked her why 22 was harder than 1, but she did not know. Then I said: "But how do you come to be 22nd in your class ? Miss C. (her form mistress) tells me you are one of her best girls." Her reply was illuminating. She said: "I am not really the 22nd. It is just alphabetical. That's the worst of it—other people never give me a 1. [The number of] my post office savings bank book is nearly all two's, too. It has not got a 1 in it." B is the younger of two children, the elder being a boy. I talked the matter out with her, and as she was an intelligent child she saw the point immediately. About a week later she said to me one day of her own accord, in a little shame-faced manner: "I never have difficulty with my number at school now." Thus her tendency to hesitate over her number was nothing more nor less than an outlet for her protest against the fact that fate had decreed that she was only second at home. But once the reason had been made conscious, the number could no longer act as an outlet for this grievance, and there was consequently nothing further to be gained by hesitating over it.

Problem Solving as Self-expression

When a complex forms part of a well-organised system the attempt to prevent it from attaining

its end is liable to produce vigorous resistance, and it is only when success seems out of the question, or when the individual feels absolutely helpless, that he is likely to allow the energy to escape as emotion. In human beings the conscious desire to master an obstacle which does not yield to familiar methods of attack, usually produces awareness of a problem which has to be solved, if the desired end is to be attained. If I find that there is a brook between me and the place to which I am going, my first reaction is no doubt awareness of the brook as an obstacle; but, if it is important for me to reach my destination, my next thought will probably be concerned with means of crossing it. In short, conscious desires when blocked give rise to awareness of problems in which the obstacle figures as something which has to be mastered or evaded. Self-expression depends on the solution of these problems, and the well-being of the self on the extent to which it can find suitable forms of self-expression. From the point of view of the ecphoring complexes problem solving is, therefore, a way of relieving tension within the self. From the point of view of primitive egotism, it is a way of satisfying the desire for concrete power and of relieving the feeling of inferiority from which every member of a community suffers to a greater or less extent.[1]

The needs which are liable to give rise to con-

[1] Cf. pp 48–52.

scious problems concern (1) the removal of a concrete obstacle, whether human or non-human, (2) the discovery of the cause of an effect or of the effect of a cause, (3) the communication of one's own thoughts, and (4) the "appreciation" of the thought or life of another. Of these the first two have undoubted bearing on the ease with which an individual can express himself, but the case is not so obvious in regard to the third and fourth, and it will, therefore, be convenient to analyse the part which these have to play, and the particular difficulties which they involve, before embarking on the psychology of problem solving as such.

The Communication of Ideas

The desire to communicate an idea to another may be due to a wish to help or teach that other. When this is the case, the act may form an outlet for the parental impulse of the instructor, as well as satisfying his egotism. What end he actually sets himself will of course depend on his attitude towards his pupils. If he looks upon them as so many unique individualities, he will give each what he considers best for his own peculiar needs; if he looks upon them as so many racehorses, he will only be interested in them as possible prize-winners. In either case the instruction he gives will, however, provide him with a full measure of self-expression.

Another source of the desire to communicate with another is the need for help, and the help which is required may be (1) aid in overcoming an obstacle or (2) sympathy in a difficulty.

We turn to others for sympathy whenever we are in doubt about our own efficiency. We also turn to them in those lighter forms of grief when we are mainly concerned with proving to ourselves that we are still of importance to others. Generally speaking, what we want of the sympathiser is that he should explain away our failures or prove to us that we cannot do what we do not want to do.[1] To give an instance: Some time ago I entered a small shop, just as its owner, Mrs. K., had discovered that she had been cheated out of sixpence. "That's how it was," I heard her say: "I gave you two threepenny bits, and him two sixpenny bits. I gave him back the shilling he gave me, and he was off too quick for me to catch him. That's sixpence gone." She had then only just made the discovery, but in the course of weighing out my pound of apples she told me the same tale twice and, as I was going out of the shop, she was beginning it again for another customer. This is sheer self-expression, without any consideration for the needs of the listener. None the less, the

[1] The desire to express sympathy is probably an outlet for the protective impulse when circumstances are such that concrete help cannot be given. Often there are also traces of self-assertion observable.

audience had an important function to fulfil. Mrs. K. knows her business, but she is desperately slow about calculating change, and has no doubt been cheated many a time. If she had been forced to think over her loss in silence, she would inevitably have come to the conclusion that it was to a large extent her own fault. But she told her customers about it. They were not likely to point out to her that there were two sides to the incident. If they responded at all, they would no doubt throw the blame on the stranger. And that was exactly the help she needed to regain her peace of mind, for it enabled her to concentrate on the weaknesses of others, instead of having to hurt her self-respect by dwelling on her own.

At times even response is unnecessary. When a person is full of some concern of his own, it is often quite sufficient to let him talk, without attempting to express any opinion. As a rule silence is taken to mean consent, and the value of such consent would appear to be that it somehow helps the individual to block the ideas of which he does not want to become aware. If no willing listener is available, and if the need is great, even the person who is merely waiting for an opportunity to get a word in edgeways is liable to be used as an audience. And such is our power of self-deception that it is possible for two individuals to enjoy a conversation which, on analysis, is nothing

more than an attempt of each to tell the other about his own affairs.

As a rule communication of this nature involves little or no analysis of the situation. It is the statement of one's own case from one's own point of view, and, so long as the listener agrees, it does not greatly matter how far he understands. When definite information is required, it is on the other hand essential to be understood, and this is by no means always an easy matter. Sometimes the listener is so convinced that he knows what is wanted, that he unconsciously misinterprets the question. At other times it is the formulation of the question which is at fault. It is impossible to state a request clearly, unless one knows the exact point at which there seems to be a connecting link missing, and the discovery of that point clearly depends on a careful interpretation of the situation as far as it is known. Often this is quite beyond the power of the enquirer. All he knows is that he does not follow the exposition as a whole, or that he cannot produce the result which he requires, and his question is consequently so vague, that it is extremely difficult to give him a helpful reply. Another obstacle which an enquirer may have to overcome, is the activity of his own inferiority complex. This is often evident in the questions which are asked after public lectures. The written question which is handed in anonymously is, as a rule, short and to the point. But the person who stands up in an audience is at

times so anxious to show that he knows what he is talking about, that it is by no means easy to discover what he really wants to be told.

A third source of the desire to communicate is the discovery of a new possession, more particularly if that new possession is a thought which has "flashed upon" the conscious self from unconscious sources. In the case of a scientific investigation, this desire will be partly due to the fact that the solution of a complex problem is often aided by the co-operation of a number of workers. But another cause is undoubtedly the primitive egotism of the worker, which urges him to use his work as a means of increasing his sphere of influence.

In this connection the scientist and the practical worker are both in a better position than the artist, for they have at least the satisfaction of having overcome a definite obstacle, even if their work attracts no attention whatsoever. Whereas the artist can only satisfy his egotism by winning the appreciation of others.

Art is, as we have seen, the expression of a phantasy[1] which owes its origin to a conflict within the self. If the product appeals to others besides its creator, the reason is that they too can use it as an outlet for a desire which they cannot satisfy in reality. The artist is, therefore, one of the healers of the community; he heals by relieving

[1] I am here again using the term Art in the sense in which it includes literature, painting, sculpture, music, etc.

tension, by giving pleasure. From the point of view of his primitive egotism, his work has, however, this great disadvantage, that it does not bring him into direct contact with the people whom he helps, and that he has, consequently, no means of observing the effect which his work produces. He cannot even work specifically for others, if he is to do his best. All he can do is to express his phantasy in as perfect a form as possible ; the rest he must leave to forces over which he has no control. In short—if we exclude the problem of technique for the moment—we may say that the artist's work may bring him influence, but that it is from its very nature incapable of giving him the peculiar sense of power that is associated with an increase in knowledge. It may be that this is the reason why the artist is on the whole more sensitive to public opinion than other workers. For him it is the only gauge of the community value of his product, for every other worker there is the solution of a conscious problem as well.

Since the appreciation of his efforts is so important to the well-being of the individual, it is vital for him to learn to present his ideas effectively, for to be accepted an idea must first be understood, and to tempt others to understand it, it must be thrown into a form which will make the efforts seem worth while. Moreover, to ensure that these others will not misinterpret it to suit their own prejudices, it must be presented in a form which

will at least reduce this unavoidable danger to a minimum. "The Writer wishes the Reader to realise as far as possible the same thoughts, emotions, and impressions as himself. To do this he must, as it were, drive the Reader to a certain goal along a certain road of his choice; and the Reader is perpetually on the point of stopping, of turning round, or of going off at a wrong turning, let alone his yawning from side to side with intolerable loss of time and effort. . . . The writer has not only to make his reader think and feel the right thing, but also to prevent his perpetually thinking or feeling the wrong one."[1] Thus form, style, and methods of presentation become matters of first-rate importance to all who wish to communicate their ideas to others.

Of all workers the artist has undoubtedly the most difficult task when he wishes to communicate his ideas to others. The scientist, the investigator, and the inventor all find in language a tool which is eminently suited to their needs, for they are concerned with the behaviour of classes or types, and those of our words which carry a fixed meaning are, as we have seen, all class-names.[2]

For these workers the actual presentation of an idea is, therefore, a comparatively simple matter.

[1] Vernon Lee, *The Handling of Words*, p. 42.

[2] E.g. the word "table" represents a class of objects, but a particular table can only be described by reference to the different classes (square, etc.) to which it belongs. Cf. Chapter II.

The artist, on the other hand, is concerned with the presentation of an individual experience, a personal impression, and he has for his tools words, forms, and sounds, which were conceived as an aid to classification. His purpose is to make at least a selected group of his fellows live through a unique experience, and the only tools he has are classes and types. At the same time the community value of his ideas depends entirely on the success with which he can present them. Hence it is both more difficult and more important for him to acquire the technique which will enable him to express his ideas adequately. In practice this means that the artist finds in his medium definite obstacles to self-expression, and that the desire to remove these obstacles is, therefore, able to function as a derivative of the complexes which have decided his profession. These obstacles in turn suggest concrete problems in the solution of which the artist becomes a practical worker and is, therefore, able to measure his success by concrete results like other thinkers. For some the search for knowledge becomes, after a while, more fascinating than the presentation of phantasies. A striking instance of this is Leonardo da Vinci, who began his scientific investigations in order to improve his work as an artist, but who was later entirely devoted to science and "very impatient of painting."[1]

[1] McCurdy, *Leonardo da Vinci*, p. 48.

The Appreciation of the Work and Life of Others

I am using the term appreciation here to stand for a process which is dynamic, and to a large extent emotional—that of living through the experience of another with the aid of the material which he has put at our disposal. Appreciation of this kind is not a matter of conscious analysis. It is a process of empathy, of "feeling one's way into" the experience of another, and the thinking which it involves would appear to be entirely or almost entirely unconscious.

Speaking of the expression of an appreciation in words Mr. Middleton Murry says: In great works of literature "the emotion will be infinitely complex, infinitely difficult to define or to describe, if only for the simple reason that to express it completely was precisely the object which the writer set himself to attain. . . . The attempt to transpose emotions of a peculiar kind into intellectual conceptions of a peculiar kind is inevitable to criticism, but the dangers of the method are manifest. Unless there is a perpetual reference back to the uniqueness of the original which we are trying to elucidate, we shall find ourselves engaged in the interesting, but slightly irrelevant occupation of trying to construct a philosophy for ourselves out of materials

which are not our own, and do not really belong to the writer we ascribe them to." [1]

Conscious problem solving and analysis will form the main subject-matter of the rest of the book. At the moment I am only concerned with appreciation as a form of "empathy."

Since emotion and thought are both dependent on ecphory, we can only "feel ourselves into" another, in so far as we have complexes similar to those which give rise to his particular form of self-expression, that is to say, in so far as we have had the necessary previous experience. And what is more, we must have these complexes in a state of tension, in which they are ready to ecphore; otherwise we shall feel that we are not in the mood for what we are being given. Thus appreciation is self-expression in the sense that it produces relief of tension within the self.[2]

In the enjoyment of art, so much of the process

[1] Middleton Murry, *The Problem of Style*, p. 33.

[2] I may perhaps be allowed to give an instance from my own experience When I saw Hauptmann's *Versunkene Glocke* for the first time one of the scenes made such a strong impression on me that it "haunted" me for days. At the time I accounted for this by the fact that the play was being performed in an open-air mountain theatre to the accompaniment of distant thunder and occasional lightning. Years later, in the course of psycho-analysis, I discovered, however, that certain unconscious complexes had seized upon this scene as a symbolic expression for a strong conflict, and that this was perhaps the main cause for the impression it had made upon me.

is unconscious, that we are not likely to become aware of the relief as such except in so far as it arises from a study of the technique of the worker. In science, on the other hand, a theory which seems to account for what has so far appeared to be a mass of puzzling contradictions may produce a feeling of tense interest in a group of fellow-workers, and, if examination proves it to be sound, there is then often a distinct feeling of relief with conscious awareness of the fact that this certainly makes one blockage the less.

In short, we tend to appreciate another person's act and thought in so far as we can use them to relieve tension within ourselves. Appreciation is consequently partial self-expression. So long as it remains pure appreciation it can, however, never be complete, because it necessarily blocks the primitive egotism of the self. Since our egotism resents every suggestion of personal inferiority, this might prove a serious obstacle to the diffusion of knowledge, if it were not being checked at every turn by the mechanism of identification,[1] but in reality our tendency to identify ourselves with our leaders is so strong, that there is, as a rule, more risk of our accepting their views uncritically than of our rejecting them because they are not our own.

The interaction of identification and " apprecia-

[1] Cf. p. 50.

tion" results in two other forms of self-expression, (1) the writing of biographies and (2) the performing of musical and dramatic compositions. In biographical work the interest is no doubt partly scientific. The modern biographer, at any rate, considers it one of his functions to present the facts of the case as accurately as possible. But, however conscientiously he studies available documents, he can only derive the dry bones of his subject from them. The rest he must obtain himself, by re-living the experience of his hero with the aid of the information he has accumulated, and that he can only do by identifying himself with him or rather with some aspect of him.[1]

The actor, like the biographer, has to identify himself with the character he is representing, if he is to make it real for others. As Beerbohm Tree tells us, "the higher aim of the artist is so to project his imagination into the character he is playing, that his own individuality becomes merged in the assumption."[2] He adds, "No art is more complex than the dramatic art in its highest expression, for

[1] In this connection see Robert Louis Stevenson's Preface to his *Familiar Studies of Men and Books*

[2] "Told with friendly concern during a revival of *Hamlet* that he was looking harassed and worn, Irving replied · 'Ah, that's nothing; only want of sleep last night. I was kept awake by thinking of that poor young fellow' 'Of whom?' 'Why, of Hamlet. Think of him all alone with his misery in that abominable court, and you won't wonder it kept me awake.'"—*Impressions of Henry Irving*, W. H Pollock, p. 66.

in none is demanded of its exponent a more delicate poise, a subtler instinct. Its laws are the unwritten laws of the book of nature, illuminated by the imagination."[1]

The same would appear to be true of the performer of music. He, too, needs, above all things, the power of feeling himself into the play of emotions which gave rise to the composition he wishes to present. If he lacks this power, he may still have a marvellous command over his instrument, but the satisfaction he derives from the execution of his art will in that case be due to the feeling of mastery which he derives from his skill, and he will be incapable of enjoying—and for that matter of giving his audience the chance to enjoy—that relief from internal strain which is the vital feature of true appreciation.

It is important to bear in mind that identification is the unconscious absorbing of a personality—not the conscious effort to imitate. What we are able to absorb depends on the complexes we have formed; what we do absorb at a given time, on the complexes which happen to be in a state of tension. Moreover, thought is blocked ecphory, and what we think consequently depends on the complexes that are being ecphored. Hence no two persons are likely to derive the same result from the same experience. This accounts for the fact that every biographer interprets a sequence of events in his

[1] Beerbohm Tree, *The Imaginative Faculty*, p. 7.

own way, every actor puts something of his own into the character he is studying, and every performer and conductor has his own ideas about the meaning which the composer really intended to convey.

The interpreter is in short an artist, but his work differs from that of the other artists in that he is to some extent bound by the selection of material which another has made for him. If this material is such that it ecphores strong unconscious complexes within him, the selection may prove a distinct help, if not, it may prove an equally great hindrance to self-expression.

SECTION II

THE THOUGHT-PROCESSES

INTRODUCTION

We have seen that thought is the psychological equivalent of ecphory, and that ecphory is the process by which the individual is enabled to use his past experience in order to solve his present problems. Also that the conscious self has the power of becoming aware of some of the ecphory as it occurs, and that this part of the phenomenon constitutes conscious thought.

It follows that the thoughts of an individual must have some relation to the needs which produced them and that each type of need will have its own particular thought-process. In all, we are able to distinguish six different forms of thought-process: Perception and recognition, when the individual has to put meaning into his immediate environment; recall, when he has to make himself aware of a past experience, construction, when he has to find a new way out of a difficulty; and finally interpretation and reconstruction, when he has to discover what someone else is doing or has done. Each of these presents its own peculiar problems, and each will therefore require to be considered in turn.

that any one of the stimulus-sets is sufficient to ecphore the whole engram group, or configuration of engram-sets. The child who has discovered that he can make a noise by throwing down a tin may have forgotten all about it next day, but if the tin becomes one of his regular toys, he soon learns what to do with it, so as to produce the desired noise. That is to say, after a time the mere sight of the tin is sufficient to remind him of the noise he can make by throwing it down. The tendency which is at work here is what is usually known as the Law of Association by Contiguity. We may formulate its action as it appears in this connection as follows :

Stimulus-sets which affect different sense-organs simultaneously produce engram-sets which tend to become associated into one group or configuration. Once such a configuration has been formed, ecphory within any one of these engram-sets readily spreads through the whole configuration, and a stimulus-set which affects only one of the sense-organs—say the eyes—is consequently able to recall the whole of the previous experience.

The tendency to form configurations for simultaneous stimulus-sets is of the greatest biological importance. When a child picks up a tin in order to throw it down, it is because visual stimuli from the tin produce ecphory in engram-sets which owe their existence to auditory stimuli. If this did not occur, it would be impossible for the

child to discover that there is a relation between the visible stimulus of brightness and the auditory stimulus of noise, and each would consequently remain an isolated phenomenon. In the same way it would be impossible for me to discover that the warmth, the glow, and the smell of burning which I am experiencing at this moment are all proceeding from the same wood-fire. As a matter of fact, objects as we know them would disappear altogether, for awareness of objects depends on the power of realising that different sense stimuli are all coming from the same source. And without the power of becoming aware of separate objects, life would be so different, that it is difficult to imagine what it would be like. To beings constituted like ourselves, it would seem that adaptation to environment would in fact become impossible under such conditions.

As it is, the stimulation of any one sense-organ puts at our disposal all the engram-sets which the stimulus-set in question is able to ecphore. We may talk of "hearing" the train. What really happens is that we hear a certain noise, but thanks to previous experience the auditory stimulus ecphores a configuration of engram-sets, which causes us to become aware of it as "the train" with little or no realisation of the noise as noise. If we had never heard a train before, the stimulus-set would still have some kind of meaning for us. We should know it as a noise, and should probably

be able to name other noises which are more or less like it. A stimulus-set can only be meaningless when it is so different from every previous experience that it does not ecphore any existing engrams. We can imagine that the first ray of light which ever strikes a baby's eyes is a meaningless stimulus or a pure "sensation," as it is often called. But once a sense-organ has been used at all, a new stimulus must ecphore previously established engrams, and must therefore carry some kind of meaning, though that meaning may of course be very vague and quite incorrect.

When a stimulus-set ecphores previously established engrams in such a way that we become aware of its meaning, we call the information we obtain in this way a *percept*, and the act of obtaining it an act of perceiving. I perceive that the train is coming in, and this percept is due to the fact that certain vibrations in the air have acted as an auditory stimulus-set, which has ecphored previously established engram-sets, and has thus made me aware of the arrival of the train.

It follows that the accuracy of my perceptions depends partly on the condition of my sense-organs and partly on the engram-sets which I have already formed. On the other hand, wrong interpretation of stimuli leads to reorganisation of engram-sets, when it is discovered. If a child has once been teased for calling a greater celandine a buttercup, he will look at them more carefully, discover the

difference between them, and henceforth perceive two different kinds of flowers where he formerly only perceived one kind.

The Part Played by Interest

We saw in the last chapter that the needs of the individual decide how new engrams become incorporated into the engram-sets which are already in existence. With the dawn of consciousness we become aware of our needs as *interests*, and of the configuration which is being ecphored by a stimulus-set as a *percept*. Hence we can say that our interests decide what we are capable of perceiving in response to a particular stimulus-set.[1] And, as it is the predominant need of the moment which determines how we actually behave at that moment, so too it is the predominant interest which decides what we actually perceive. An artist may perceive an oak-tree as a fine subject for a study, a boy as a tree worth climbing, a botanist as an interesting variety of oak. Or again, on a walk along a country road, the botanist tends to perceive the flowers, the farmer the crops, and the motorist the road, but the farmer who is something of a botanist may only be perceiving the state of the road, if he knows that he will have to drive his car over it. Each perceives what his interests make him want to know, and the

[1] Assuming, of course, that we have the necessary knowledge

predominant interest of the moment decides what will be seen and what will be ignored at that moment.

When we are reviewing what we perceived in the course of an occupation which lasted some little time, we may find that we became aware of stimulus-sets which had nothing to do with the main line of interest. In such a case it can always be shown that all our energy was not absorbed by what we were doing, and that other interests and sentiments could consequently become active. If a boy is riding a bicycle by himself for the first time, he is not likely to notice the flowers by the roadside, even though botany is his special hobby, for he will need all his attention for the management of his machine. After a little practice his riding will need less attention, though he may still be rather afraid of the traffic. At this stage he may come home with the remark, "There seem to be lots of flowers along that road," or even—"I got off on purpose to pick this mullein." Both remarks show that his interest in botany was able to make itself felt, although his main object was to learn to ride his bicycle. On the other hand, the fact that he perceived the flowers is due to the fact that he had this subsidiary interest in flowers. If he had been more particularly interested in cars he would probably have noticed the makes and numbers of the cars on the road instead of the flowers, in so far as he could afford to pay attention to them. To

sum up: Interest decides what we perceive, and if we find ourselves noticing things which belong to different categories, it is because our main occupation does not need our constant attention, and other complexes are therefore able to find expression.

Since perception depends on knowledge and interest, it follows that we cannot perceive where we have not the necessary knowledge and that we do not perceive where we have not the necessary interest.

In this connection it is important to remember that the person who does not perceive what does not concern him is not consciously ignoring what might possibly interfere with his other interests. Owing to the Law of Mutual Blockage he is simply not aware of the stimulus-sets which do not satisfy any of his momentary needs. In other words, it is not due to any negligence on his part; it is simply due to the way he is made.

Here is a case in point. A certain student had to make a sketch of a spindle-tree. She was told she would find some on a certain hill at a considerable distance from her home. She went there, found the plants, and made the required sketch. But when she was strolling round her garden at home that evening, she suddenly found herself looking straight at a spindle-tree. Although she spent much of her spare time in the garden, she had never been interested in the individual bushes

as such, and had therefore never discovered that there was a spindle-tree among them.

In the same way some people do not know the names of the roads along which they go every day; others do not know whether there is a pillar-box on such a road. In all these cases stimulus-sets which the individual could interpret without the least effort are ignored, because they are momentarily of no interest, that is to say, because they do not help to satisfy a present need. In short, we owe our powers of perception to the urge to live, and we therefore only perceive what concerns our needs.

The Growth of Percepts

In the first months of an infant's life there is as yet no conscious desire. But even at this primitive stage it is the need of the individual which decides what is perceived. In his *Growth of the Mind*, Professor Koffka has given us an account of the development of percepts in infancy and childhood. He finds that stimuli which are connected with pleasure and pain are the first to be singled out, and that a complex stimulus-set which has a definite feeling tone is recognised before a simple stimulus which has none. Thus the child recognises the human voice before other sounds, the human face before a simple colour, and at about the age of

six months it is apparently able to distinguish a friendly from an angry face.[1]

With regard to objects, the earliest configuration would appear to consist mainly of elements of form. Koffka gives the following quotation from Stern: "Once when the baby was eight months old, while waiting for his bottle, he was shown, by way of a joke, a doll's bottle about one-fifteenth the usual size. He became greatly excited and snapped at the bottle as though it were the real one."[2]

Moreover, according to Stern, the crude outline at first determines recognition, whereas the finer details are only noticed at a much later stage.

The tendency to concentrate on form at the expense of position is still noticeable at the age of five and six. As every teacher of young children knows, little people at first copy letters in all possible positions, including upside down, and are even quite content to look at their picture-books upside down.

We owe to Koffka the enunciation of another quality of growing configurations, which is of great practical importance. This quality may be stated as follows: "A configuration which arises under favourable objective conditions reappears also when the conditions are less favourable."

Koffka quotes the following experiment of Koh-

[1] *The Growth of the Mind*, pp 133–4.

[2] *Op. cit.*, p. 288.

ler's in support of it: "A B C D E—E being the reddest—were five different colours lying between red and blue, whose nuances were easily distinguishable by man. Taking the pair B C, the chimpanzee was required to learn to react to the markedly reddish C. This attempt was a failure. The interval was then increased, and the investigation continued with the pair BD. The selection of D was then rapidly learnt. When thereafter the pair B C was again offered, C was chosen correctly without an exception, and some time later D was selected without an exception in the interval C D." He adds: "This result is very important to us for the following reason. At first it was impossible to construct a definite configuration of B C, although occasionally it proved effective: but the configuration B D took place at once, and thereafter both B C and C D were effective."[1]

In case the reader should have any doubt about the applicability of this result to human beings, it may be worth while to give once more an illustration from the teaching of geometry. Pupils of thirteen to fourteen, who have learnt that angles which are in the same segment of a circle are equal in magnitude, often experience distinct difficulty in finding the angles which are in the same segment in a figure such as Fig. 3 A, but after practice with figures, such as Fig. 3 B, this difficulty disappears, and to their own surprise they then find that they

[1] Koffka, *op cit*, pp. 273, 274.

can now see the equal angles quite easily, even when the figure is complicated.

Finally, even when the parts have been realised within the whole it may be impossible to recognise

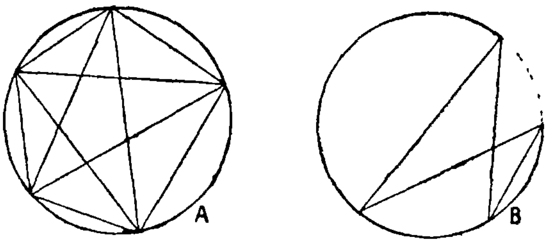


FIG 3

them in other settings. Thus Binet found that a child of four years and four months did not recognise an ear, a mouth, or a finger, when they were presented by themselves, though it had no difficulty in pointing to them in their proper setting. As Koffka points out, there are close ethnological parallels of this fact. "Thus in many languages it is impossible to say merely 'hand,' because hand is always the hand of a particular person. If, for example, an Indian were to find an amputated arm, he could not say 'I have found an arm,' but he must say 'I have found of someone his arm.'"[1]

THE ORIGIN OF ILLUSIONS

Like all inborn mechanisms, that which selects what we perceive also tends to err on the side of

[1] *Op. cit*, p 293.

safety. When I am waiting for friends, I may think I see them half a dozen times before they actually arrive, for the desire to see them will cause the engram-sets which are connected with those friends to ecphore so readily that any persons of about the right build will appear to be the friends in question, until they come near enough for me to notice that they are strangers. In the same way the person who has been told that there is a ghost in a certain room is liable to perceive a ghost where otherwise he would only have seen a patch of moonlight on the wall, and the pupil who has been told that burning phosphorus over water will make the water rise in the bell-jar, will cheerfully think that he sees the water rise when he is much too far away to see anything of the kind.

When our sentiments lead us astray in this manner, we speak of having *illusions*. An illusion is therefore obtained when a stimulus-set ecphores the wrong engram-sets, and consequently produces the wrong meaning.

In the instances which we have given, the illusion was due to the fact that a predominant interest caused certain engram-sets to be too ready to ecphore. In other cases it would be more correct to say that long-established habits are the cause of the illusion. I have seen a child run away in real fear when an adult chased him playfully with a stick. He did not notice the playful tone of the adult, he simply saw the raised stick which past

experience had taught him to dread. The illusion was therefore due to the fact that part of the stimulus-set so readily roused its customary meaning that the rest did not become conscious at all.[1]

Certain visual illusions are usually supposed to be due to the same cause. The reader will, for instance, find it very difficult to see Fig. 4 as a plane figure. His natural reaction is to see it as a

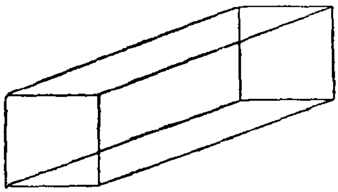


FIG 4

solid, though he knows quite well that it is drawn on a plane surface. It is supposed that we are so accustomed to interpret this stimulus-set as the sign of a solid, that a special effort is needed to realise that in this case we are only dealing with six parallelograms drawn in the same plane.

Unconscious Recording of Stimuli

We have seen that our interests decide what we consciously perceive at a particular moment, but it would be a mistake to imagine that this means that we only form engrams for the stimuli of which we are consciously aware. At times it is easy to

[1] Cf. *Discovery of Electric Shock*, p. 198.

show that a stimulus-set did form an engram-set, even though there was no apparent awareness of it. The reader may have had the experience of offering to fetch something, and then being told to his own surprise that he had been asked to fetch that very thing a few minutes before, but had apparently been too immersed in his book to hear what was being said to him. In such a case we must assume that the engram-set was formed, but that it could not produce conscious awareness until the predominant need of the moment had been satisfied.

Another instance of the same tendency is probably given by the case of the engineer, who wakes up at night with the conviction that a certain machine must be overhauled the very next day. It seems justifiable to suppose that stimulus-sets from that machine formed engram-sets, which could not produce awareness whilst the man was occupied with other things, and consequently did not become conscious till his mind was at rest at night.

According to some, every stimulus-set forms an engram-set, whether we become consciously aware of it or not. This is difficult to prove in practice, but experiments with hypnotised subjects have at any rate shown that stimuli produce many engrams of which the conscious self never becomes aware.

At times a stimulus-set may not produce awareness because an unconscious complex takes possession of it, in order to use it as a symbolic outlet for its impulsions. Here is a case in point. I once had

to analyse a dream in which the striking feature was a certain Egyptian figure in rather a peculiar position. Analysis soon revealed that that Egyptian figure had been used as a symbolic expression for a strong unconscious complex, but this did not explain why that particular symbol should have been chosen, and the dreamer declared that she knew nothing about things Egyptian, and was in no way interested in them. Some days later she was turning over the pages of one of her fashion-books, and there she found the very Egyptian figure in one of the transfers that were given away with the book. She had certainly glanced through that book before, but had as certainly not been consciously aware of the sheet of transfers. We must assume, then, that the transfer did produce an engram-set, but that the engram-set did not become conscious, because it was as it were appropriated by the unconscious complex. If the dreamer had not been having analysis at the time, she would not have discovered the meaning of the symbol, and the unconscious complex might have used the figure again and again without interference from the conscious self.

Recognition

In one sense every act of perceiving involves recognition of the familiar features of the stimulus-set, but we do not usually talk of recognising a person or an object, unless there is sufficient diffi-

culty about the process to make us aware of it, that is to say, unless the naming of the stimulus-set has had to become an end in itself. I know *that* is a table, I know that is a rock, but I do not know how I know. In fact it seems rather absurd to ask me, for experience has long ago rendered the process mechanical. On the other hand, I recognise this as the table which you bought at the sale last year; I recognise this flower as a labiate, I recognise my friend in spite of his disguise. In all these cases the process of classification becomes conscious as an end in itself, just because it was not automatic. We may say, then, that the act of recognising is an act of perceiving, in which the predominant interest is that of identifying or classifying.

As in the case of other acts of perceiving, previous knowledge and experience decide what an individual recognises at a particular moment. A boy who has been learning Latin for a term, and who is proud of his knowledge of Latin, may make valiant efforts to translate the sentence "Cæsar ad sum jam forte," whereas a boy with rather more knowledge will recognise it as a meaningless string of words or a catch of some kind, and a boy who dislikes his Latin lessons may "recognise" it as Latin and thereupon refuse to look at it again.

As I showed in Chapter II, we have to learn to classify all the stimulus-sets, which come to us from our environment. With the child, the only

method is trial and error. If he gives the right name he is praised; if he gives the wrong name, he is corrected. At first the child's manner shows that he is definitely trying to recognise a stimulus-set, later the process becomes automatic, and he simply names the object correctly, without giving it a thought.

This method is at our disposal throughout life; it is Nature's way of teaching us. We can, however, greatly hasten the process by using our powers of conscious selection and discrimination. Since recognition depends on the ecphory of the same engram-sets when the same stimulus-set recurs, we can help ourselves by definitely selecting the marks which will be useful for our purpose. We shall then look for those marks when we perceive the person or object the first time, and look for them again when we have to recognise that person or object on a future occasion. In the case of an individual, our success will clearly depend on the selection of marks which are permanent and not easily hidden. The face, the build, the voice and the walk of an individual are all fairly safe means of recognition, and persons who have to deal with large numbers usually find some combination of these helpful. A suitable disguise may of course hide some of them, but only an expert would succeed in hiding them all at the same time.

If our business is to recognise a specimen as a member of a class, the process is still the same. We

can only classify a specimen correctly, if we know the recognition-marks of the relevant classes. In many cases these have already been ascertained by other workers. In the case of plants there is, for instance, a tried system of classification at our disposal, and it will obviously be quicker to learn to recognise plants by this system than to try to invent a plan of one's own. (There may of course be many reasons for wishing to form a new system of classification, but this is a problem which does not concern us here.)

As in the case of individuals, so too in the case of specimens, unusual conditions may at times mislead the observer. A fly flying across the face close to the eyes has before now been mistaken for a bird in the distance, because the closeness to the field of vision made it appear unusually large. A particularly vigorous specimen of, say, ground ivy may mislead the inexperienced student, if he has not yet learnt to look for essentials and nothing but essentials. But on the whole recognition is easier in the case of specimens than in the case of individuals, just because the observer is usually not left to his own resources in the selection of suitable marks.

Whilst success in recognition thus depends on the selection of the right characteristics, this is not the only condition. The other is that we should consciously wish to recognise the stimulus-set. Otherwise we shall only be able to recall the points

which happen to have made a particular impression on us, and these may well be far from permanent.

There is one final problem connected with recognition which should be mentioned here. That is the origin of the feeling of familiarity which an individual experiences in situations which he knows to be new to him. It is usually called the phenomenon of *déjà vu* or of *fausse reconnaissance*. Freud has shown that in these cases it is an unconscious or suppressed phantasy which is being ecphored by the new situation and which gives rise to the feeling that all this has happened before. Thus a woman, who was trying to hide from herself that her father had lost much of his mental vigour in the course of a long illness, once experienced a strong feeling of familiarity when she was visiting the ruins of a fine old cathedral. The sight of the ruins ecphored her fears about her father. If there had been no suppression, she would have become conscious of them as a symbolic representation of her father's present condition. As it was, nothing of the kind became conscious, and all she realised was the feeling of familiarity which was produced by the ecphory of the suppressed material.

In order to prove the truth of this explanation of the feeling of familiarity, far more detail would have to be given than is possible within the limits of this book. The reader is therefore referred to Freud's *Psychopathology of Everyday Life* (p. 321), where he will find the full analysis of a case.

CHAPTER VII

RECALL

If an experience is to teach us anything, it must make a lasting impression upon us, for only then will it be able to affect our behaviour on a future occasion. In terms of the engram theory this means that the stimulus must form an engram which is still able to ecphore when the stimulus is repeated after an interval. The power to form such " effective " engrams is often called the *natural retentiveness* of the organism.

Observation shows that species vary greatly in natural retentiveness. Generally speaking, organisms which have a central nervous system, learn more quickly than those which have not, and among the higher animals increase in the complexity of the nervous system has brought with it a corresponding increase in the ease with which effective engrams are formed.

Individuals probably also differ in their natural retentiveness, but in man, at any rate, these differences are relatively unimportant, for the actual power of recall over which a person disposes depends far more on the methods which he uses and the intelligence which he enjoys than on the degree of

natural retentiveness with which he happens to be endowed.

Observation shows that recall may be voluntary or involuntary. Voluntary recall implies a conscious effort to bring back to mind a previous experience, such as an accident which has been witnessed or a formula which has been learnt. In terms of the engram theory, it is an attempt to cause certain configurations to ecphore in such a way that the conscious self is able to become aware of their existence. On the other hand, involuntary recall is the recall of ideas without, or even against, the will of the conscious self. It provides material for our day-dreams, and sometimes annoys us with tunes or quotations which seem to pursue us for the time being. In terms of the engram theory, it is therefore ecphory which produces awareness without the desire of the conscious self. In what follows we shall consider first voluntary, then involuntary recall.

I VOLUNTARY RECALL

What we wish to recall at a particular moment obviously depends on the need of that moment. It may be among other things a personal experience, a fact which we have learnt, or the actual words in which someone else has expressed an idea or a formula. Every one of these must have acted as

a stimulus-set when the necessary engram-set was being formed. I shall use the term "material" to represent this miscellaneous collection of experiences.

The success with which material can be recalled at a particular moment depends both on the way in which it was acquired, and on the conditions under which it is being recalled. It will be necessary to consider these separately.

A. *The Learning Period*

Whilst new material is actually being experienced or learnt, the factors which are of importance from the point of view of future recall are (1) the physiological conditions under which it is being acquired, (2) the interest which it is evoking, and (3) the skill with which it is being incorporated within the existing systems of knowledge.

In what follows I shall take each of these in turn.

(1) *The Physiological Laws of Growth*

In terms of the engram theory, to learn is to form engrams which will ecphore when required, and one condition for ecphory is obviously a sufficient degree of permanence. Two problems arise. (1) What are the conditions which are favourable to the formation of a new engram? and (2) What are the conditions which are favourable to its permanence? Since an engram is a physiological change which has been

wrought within the organism, these conditions must be partially physiological. We will begin by considering these.

When we learn material for practical purposes we rely largely on psychological factors such as the meaning and the relation of the parts to the whole. In order to exclude these factors as far as possible, it is necessary to choose material which can only be learnt mechanically, such as the lists of nonsense syllables, which were used by Ebbinghaus, the first investigator of this subject. A nonsense syllable is a meaningless word of three letters, which is formed by placing a vowel between two consonants, e.g. *baj*, *dez*, *pof*, etc. Ebbinghaus constructed lists of nonsense syllables, and set his subjects to repeat them, until they could say them once without a mistake, and then to relearn them after varying intervals. Meaningless material of this nature is quickly forgotten, and will consequently require relearning after quite a short time, but experience shows that it is learnt more quickly on the second occasion, and that further repetitions of the experiment produce a further reduction in the learning time. In this way Ebbinghaus obtained a means of measuring the effect of each learning period.[1]

Experiments similar to those of Ebbinghaus have since been repeated by a number of workers. The most important of the results which have been obtained in this way are:

[1] Cf. Ebbinghaus, *Memory*.

(7) Another point which has been studied in connection with mechanical learning is the way in which imagery should be used in order to economise effort as far as possible. Should we visualise what we are learning, should we try to say it to ourselves, or should we ask someone else to read it to us? Physiology has taught us that each sense-organ has its special brain centre where impressions are "registered." Hence it is probably economical to use as many centres as possible in order to register the required facts in as many ways as possible.

(8) Finally Dr. Sleight has conducted an interesting investigation into the way in which the material which is being memorised and the method which is being used are likely to affect the learner's general power of memorising. He comes to the conclusion that improvement occurs when one method of memorising is used consistently, and that this improvement then affects the learning of all material which is subjected to that method. That is to say, the person who trains his power of learning some one kind of material visually thereby improves his power of learning all material visually, but he does not improve his power of learning auditorily or kinæsthetically. Each method must be practised separately.[1]

The kind of learning that I have been describing does not exist outside the laboratory. Under

[1] Sleight, "Memory and Formal Training," *British Journal of Psychology*, vol iv

normal conditions material is only learnt, if it has a purpose, that is to say, if it has meaning, and the process of growth is therefore complicated by the activity of other tendencies All the same, the fundamental laws must continue to affect the growth and permanence of engrams, though their effect is usually hidden by that of other forces. The learning of poetry forms a good illustration of this point. Most people find it helpful to break up a poem into meaningful wholes, and to study the relation of the parts to the whole, before attempting to memorise it. At the same time experience shows that a poem is learnt more quickly and remembered for a longer time, if it is learnt with concentration of attention, with a suitable distribution of repetitions, with a short rest immediately after each learning period, and with the method which happens to be habitual to the learner.

For our purpose this general survey of the physiological factors is all that is needed. In what follows I shall therefore confine myself to the part played by psychological tendencies.

(2) *Interest*

I have already had occasion to point out that material can only function as a stimulus, if it is of interest to the individual, that is to say, if it is able to ecphore one of his complexes. Moreover, as we saw in the case of the Egyptian figures, a stimulus will not even be perceived consciously, if it only

ecphores unconscious complexes. Hence material must arouse conscious interest, if it is to produce engrams which can be ecphored by the conscious self.

Moreover, the attention must be directed to the particular elements which are likely to be wanted at the time of recall, for interest is of necessity selective and we can only recall what we have registered. The child who is copying a word in his best handwriting often has not an idea how he is spelling it. He is concentrating on the form of the letters, not on their sequence, and consequently it is only the form which he is learning. Similarly, it is quite possible to read a passage or to copy it out correctly with very little grasp of its meaning, if the mind is at the time occupied with something else.

Interest also affects recall in another way. We have seen how subject we are to illusion, more particularly under the influence of a strong desire. It is of the essence of an illusion that it feels real until it is corrected by experience. When events follow swiftly upon each other—say when an accident is being witnessed—it is therefore easy to mistake an illusion for a percept, and to register it as such. Moreover, an experience which has a strong emotional tone tends to produce a flow of ideas under the influence of the various complexes which it ecphores, and these ideas tend to become so closely associated with the real incidents, that the observer afterwards

mistakes them for part of the actual occurrence. Thus a configuration which is being formed at a time of stress is liable to contain much that is illusion or phantasy. Yet to the person himself it all seems equally real. It is for this reason that the testimony of a single witness is not considered sufficient, even if he is known to be perfectly honest in his intentions. It is impossible for anyone to be certain that he has not mistaken the imaginary for the real under the influence of a strong emotion, and it is therefore essential to have another independent account, if the truth is to be ascertained.

Even when there is no particular emotional stress, we sometimes find it difficult to distinguish phantasy from reality. In such a case the adult usually settles the matter by trying to recall what happened before and after the event in question. If he can fit his recollection into a series of happenings which he knows to be real, he assumes that it must be based on a true occurrence. If not, he decides that his imagination must have led him astray.

But this critical attitude towards one's own experience is only acquired under the influence of suitable experience. For the child there is at first no distinction between the real and the imaginary, and even at six or seven, when he has in some respects acquired a very clear idea of the distinction, he often still finds it hard to realise that his phantasies are mere make-believes. During the next few

years, experience gradually teaches him that the world of the imagination is not the world of real life, and by the age of ten or eleven he has usually acquired a fair amount of skill in distinguishing between the two. However, some individuals find this process more difficult than others, and confusion may still occur much later. Thus a rather lonely child of twelve and a half once described to me in some detail an afternoon which she had spent with us at a time when we were actually away from home. This may be considered nothing more than a reminder, especially as her visits meant much to her, but, *as a matter of fact*, the "do you remember how . . ." came after she had had her invitation.

To sum up. If there is no interest in the material it cannot act as a stimulus-set, and will consequently not be recorded at all. If there is interest, what is recorded will depend on the particular need of the moment—and under the influence of emotional stress or a strong desire, both illusion and phantasy are liable to be recorded as reality.

(3) *The Organisation of Knowledge*

Every one has had the experience of not being able to recall facts which he "really" knew quite well. As will be shown later, a blockage of this kind may be produced at the time of recall by the activity of contrary interests. It may, however, be due to the way in which the facts were recorded when they were functioning as stimulus-sets. This

is the aspect of the problem which concerns us here.

We have seen that engram-sets must be ecphored together in order to become associated together in such a way that ecphory will thereafter spread readily from one to the other. We have also seen that the engram which is formed by a stimulus, only becomes incorporated within the systems which are actually ecphoring at the time.[1]

In consequence of these tendencies each complex incorporates within its system such knowledge and *only* such knowledge as has proved of use to it, with the result that it has at its disposal what it wants and is not led astray by thoughts which have nothing to do with the subject in hand. Thus the person who is reading a life of Wolsey is not likely to think of the advertisement of Wolsey underwear, in spite of the fact that Cardinal Wolsey figures in both, for the two belong to systems which have no interest in common, and are therefore not likely to be ecphoring at the same time.

But whilst this is on the whole to our advantage, it is at times a distinct hindrance. For there are, of course, occasions when this mechanism renders it impossible to recall a fact which is quite familiar in other connections, because it does not form part of the system which is ecphoring at the time and is, therefore, non-existent for that system. Thus children who can discuss floating bodies quite

[1] Cf. Law of Mutual Blockage, p. 45.

intelligently in their physics lessons, may yet be thoroughly puzzled when they are asked in a botany lesson why ice should form at the top of ponds instead of at the bottom, because they have never yet had occasion to connect the two subjects.

It is important that this tendency to form mutually exclusive systems should be borne in mind when new material is being acquired. At the moment of perception or comprehension a particular material always serves a particular purpose and it is that purpose which decides the system within which it will be incorporated. If it is likely to be wanted in other systems as well, it must be incorporated within them by a conscious direction of interest, otherwise it will not exist for them until some chance occurrence has caused it to ecphore them.

This conscious direction of interest produces two forms of mental activity: (*a*) the organisation of material into systems which have been invented under the pressure of special needs, such as the construction of lists of facts as an aid to thought or as a means of passing an examination, and (*b*) the application of a generalisation, such as a rule of grammar or a mathematical formula, to the particular cases which belong to its system. Each of these processes suggests certain points of interest:

(*a*) When a child learns the properties of an object, such as toffee, he learns them through actual

use and experience. The object is a centre of interest for him, but new properties only become incorporated within its system, in so far as they are of use to him. If an artificial system is to be learnt with the minimum of effort, this method should be imitated as far as possible; that is to say, there should be a definite centre of interest and the necessary facts should be grouped round it and related to it in some way. In this way the same system is being ecphored for each of the facts and, since repetition makes for permanence, the whole is, consequently

FIG. 5.

learnt with less effort than would have been the case without such organisation. In the case of visual learning, the actual arrangement of material is also of great importance. In Fig. 5 (1), (2) and (3) consist each of five lines, but the first represents one whole, the second two wholes, whereas the third requires definite effort to organise it. Experiment shows the whole is the unit in visual learning. Material of this kind should, therefore, always be systematised before it is memorised.

(*b*) The way in which an individual learns to use a law or formula is interesting in relation to the growth of systems, because it shows the dependence of growth on conscious direction of interest. As an

example of this, I shall take the laws which govern the relative position of the accusative and dative of French pronouns, when they occur in the same sentence. If the teacher knows his business he has introduced the subject by letting his pupils formulate these laws in their own words from examples which they have found in their reading. In such a case, every pupil knows what is wanted. Yet every one of them is liable to make mistakes, more particularly after the novelty has worn off; for the law has only become associated with the particular examples on which interest was being concentrated at the time of its formulation, and new settings continue to require conscious recall of laws or model sentences. A pupil may, for instance, be able to produce *je le lui donne* without thought, and yet have to use conscious effort to find *je les leur donne*. As one form after another becomes familiar through use, the process slowly grows more mechanical, until presently the right phrase appears in consciousness without any effort on the part of the self. In other words, every form has to be acquired in response to a definite need. Though the pupil knows that the plural of *le* is *les*, the phrase *je les lui donne* may require effort after *je le lui donne* has become familiar, because the configuration for the position of pronoun tends to function independently of the configuration for the plural of pronouns.

To sum up: Material is only incorporated within

the systems which it has ecphored, i.e. within the systems to which it has at some time or other been of interest. In consequence of this, knowledge tends to be acquired in mutually exclusive systems, each of which has been formed in response to a definite need. At the moment of recall ecphory can only spread within the system which is being stimulated, hence material only exists for a system after it has been actively incorporated within it. If two systems, A and B, have a common element (e.g. "floating bodies"), this does not make the knowledge of B available for A unless B is ecphoring as well as A.

Conscious organisation of knowledge consists in the formation of artificial systems and the association of material from different systems under the influence of conscious desire. To be successful it must imitate the methods by which natural organisation is secured.

B. *The Moment of Recall*

When material has been recorded in such a way that it forms a permanent engram-set, its recall depends, as we have seen, on the ecphory of one or other of the systems within which it has been incorporated. Since ecphory depends on interest, it follows that blockages which arise at the moment of recall, when the material is theoretically available, must always be due to some conflict of interests.

It will be convenient to begin by taking a definite example. In order to obtain one, I stopped writing at this point and tried to recall what I was doing at five o'clock on the preceding afternoon, noting down the line of thought as soon as I had discovered what I wanted. The result was as follows: "At two p.m. I was at the station to see about my ticket." Vague thoughts about this, then—"But that's beside the point." Then a gap. Then—"Oh yes, at five p.m. I was working; I had been working since three p.m., and I looked at my watch at five-twenty." Then a slight feeling of satisfaction, followed by a momentary pause and a feeling of discontent. Then—"But that is too vague. I ought to have known that at once. What was I actually doing at the time?" Then another gap. Then—"That was where I left off last night. I must have been working on that part of recall. It was that part. I felt I was not getting on at five-twenty. That is why I stopped then." All this came very quickly, so quickly that I cannot be sure that I managed to write it down exactly as it came. Then there was a feeling of relief accompanied by the conviction that I had solved my problem.

One thing to notice is that the ideas are disconnected, and that there are "gaps" between different groups. So far as I can tell, nothing went on in the mind during those gaps. Yet something was evidently happening, for the next thing that became conscious certainly brought me nearer to

the solution of my problem. It seems probable that the intervals were taken up in the ecphory of various engram-sets, which did not become conscious, and that the engrams which did cause awareness were those which seemed to give me the necessary information. Another point to notice is that each solution was immediately supported by other facts, which made the recall more complete, and that this datum was accepted quite uncritically as proof of the fact that I really had discovered what I was wanting to know. In the first case, the evidence was good: since I was working from three to five-twenty I must have been working at five. In the second case it was valueless, for the fact that I was engaged upon a certain section at five-twenty does not prove that I had already started it at five. But at the time it did not strike me to criticise either. The fact that other ideas did become conscious as well was apparently sufficient to give me a feeling of satisfaction. Finally, it will be seen that the first thought of which I became aware had nothing whatever to do with the problem in hand. We shall have occasion to discuss this in detail; here it is sufficient to note that it was evidently produced by the activity of some rival complex.

If the reader will try some experiments on himself he will find that this is one fairly representative of what usually happens. Some of the ideas which become conscious are due to other

interests, the rest are partial solutions of the problem which may produce a momentary feeling of satisfaction, but are necessarily rejected as soon as their insufficiency becomes clear.

As a rule the ideas come in little groups, and there are gaps during which the thinker is either aware of nothing at all or only of imagery which is too vague to record. Solutions are, moreover, often accompanied by so-called reasons, but these reasons are only incidents or thoughts which belong to the same group as the fact which is wanted. The value we assign to reasons will be discussed in the last chapter. In this we are only concerned with the recall as such.

It may be found helpful to have a diagrammatic representation of what is involved in an act of recall. For the sake of simplicity I shall assume that there are no rival interests to consider. In Fig. 6 *a*, *b*, *c* are the engrams or engram-sets for the facts of which an individual is aware. *x* is the fact he has to discover. After early infancy any particular fact belongs to a number of groups of ideas, that is to say, its engram-set forms part of a number of configurations. The phrase five o'clock could for instance suggest a multitude of different things. This is indicated in the figure by the lines which radiate from each engram-set. A line between the engram-sets is therefore taken to mean that the two sets form part of the same larger set. *a*, *b*, *c* can each suggest a number of ideas, as is shown by

the radiating lines. *y* represents a partial solution which will have to be rejected if *c* becomes conscious, *z* a partial solution which will have to be rejected if *a* or *b* becomes conscious. The problem will only be solved when the system *a*, *b*, *c*, *x* is ecphoring in such a way as to make *x* conscious. The reader

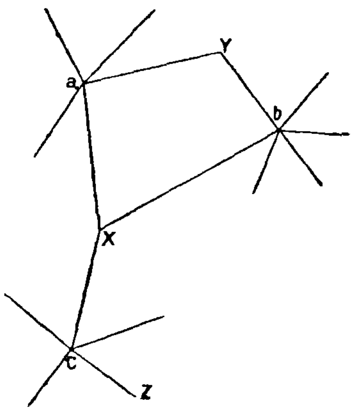


FIG 6

will see from this that even a simple case such as that given in the illustration may give rise to many false attempts before the right solution has been found. Finally, when a set is ecphoring any of the engrams which belong to it may produce awareness, and it is the ecphory of some of these which is so readily accepted as proof of the correctness of the solution. Awareness of elements associated with *a*, *b*, *c* certainly shows that we are working with the right engram-sets (*a*, *b*, *c* ; *x*), but it by no means shows that *x* is the one for which we are looking.

This tendency to become aware of associates suggests, in turn, another problem. When an individual wants to recall a fact, he usually does not allow side issues to interfere with his line of thought. As soon as he finds that he has only discovered a partial solution, he starts again; and when he has eventually discovered what he wanted he uses it to satisfy the need in question. He has no interest in the associates as such, except in so far as they seem to prove the correctness of his solution. Recall is in fact perception turned inwards. Of all the potential stimulus-sets which surround us we only perceive those which help to satisfy the need of the moment, and of all the engram-sets which might become conscious owing to association by contiguity we only recall those which help to satisfy the need of the moment.

It may be thought that this tendency to work within isolated systems must seriously limit our power of voluntary recall. But as a matter of fact just the opposite is the case. It is not difficult to show that it is just this tendency which makes voluntary recall possible.

As we have already seen, the urge to live causes every individual to build up highly complex systems of engram-sets whose elements are inter-connected in all sorts of ways. Under the influence of association by contiguity any element may arouse any

other with which it has ever been associated, and after early childhood any of the commoner elements is consequently a potential starting-point for a large number of paths. The reader need only think of the number of thoughts he can call up in connection with a relatively limited idea, such as that of "a small white dog." If then we had nothing but the Law of Association by Contiguity to guide us in our desire to recall a given fact, every association that we had ever formed would provide a possible path, with the result that system after system would ecphore in the course of our search and only exceptional good luck could save us from getting lost in this maze of our own making. But the tendency which we have called the Law of Mutual Blockage saves us from all this by limiting the ecphory to the engram-sets which are incorporated within the complex which is predominant at the moment. This confines the field of search within possible limits. It is of course true that the Law of Mutual Blockage also prevents the recall of what is not incorporated within the system of the complex, and may thus occasionally prevent us from recalling the fact we want, although we really "know" it quite well. But this is a small matter when we realise that the alternative would be aimless searching through the whole of our previous experience. If we fail when we ought to succeed, and if failure is not due to the activity of rival complexes, all it means is that we have not put a

particular bit of information into the system in which it is wanted, and this is a matter which is easily remedied.

We started this discussion by saying that an individual usually makes straight for the thing that he wants without allowing side issues to interfere with his search. Everyone must have come across cases in which this was not true. At times a thought comes up from "nowhere" or a "chance" association carries us away, and it requires a definite effort to return to the task in hand. There was an instance of this in the introspection which I gave on p. 136. Here the task was to recall what I had been doing at five p.m. on a certain afternoon, and as I have already had occasion to point out, the first fact of which I became aware had nothing whatever to do with the solution of my problem. As it happens, I can, however, account for its occurrence. There was a difficulty about train service which I discovered when I took my ticket and of which I had been thinking on the morning in question. That difficulty had certainly caused ecphory within fairly strong complexes, but it was not a matter of first-rate importance and I had put it aside without conscious effort when I sat down to my work. Yet it was evidently still ready to ecphore. The fact

that it found the particular outlet which I have mentioned is due to something else. Everyone has probably had the experience of trying to recall what he was doing at a particular time and of turning to some other time for which he could account in the hope that that would help him to recall what he wanted. I had been thinking of this tendency just before I tried my experiment and was half expecting that I should first think of another time on the same afternoon. Here was the opportunity for the idea which I had consciously put aside before I began to work. Consciously I was expecting to find myself thinking of another time before I could recall what happened at five o'clock. Preconsciously I was wanting to think about the complications that were being produced by the absence of a suitable train. Thus the conscious and the suppressed were for the moment working in the same direction, with the result that I satisfied my conscious expectations by thinking of the wrong time, and my suppressed desire by recalling the difficulty about the train service. In short, the side thought was due to the activity of a rival complex which had been suppressed temporarily, but which was evidently still ecphoring.

The reader will find that "chance" associations and thoughts which seem to come from "nowhere" can always be explained in this way, if their source can be detected. Owing to the complexity of our engram-systems the dominant complex is certain to

have associated with it engram-sets which also belong to a number of other complexes. If one of these happens to be in a state of tension, ecphory of the common element may enable it to ecphore and may thus divert the line of thought to its needs. If it is strong, it may even cause the individual to forget all about his original problem, and turn his attention entirely to those raised by the rival need.

Closely connected with this is our inability to recall facts which should ecphore quite readily with the dominant complex of the moment. As the reader has no doubt learnt from experience, it is usually a waste of time to try to force such a fact into consciousness. Undue eagerness only produces side issues and, the more excited we grow, the less likely are we to find what we need. But, if we give up the search, and turn our attention to something else, the fact often becomes conscious of its own accord. Suddenly it is there again, it may be hours and days later, and as a rule it is impossible to say where it came from or why it should have appeared at that precise moment. There is good reason to believe that this type of forgetfulness is always due to the activity of some rival complex which is strong enough to block the way to the required engram-set. If we look up the fact we have forgotten instead of waiting for it to come back, we can often prove that this is what happened: there may, for instance, be associations with something which is hurting our

self-respect or with something of which we would not want to remind the person who asked for the information. If there seems to be no conscious reason, the method of Free Association usually reveals that some unconscious complex has been at work. In short, it would seem that the individual who finds himself unable to recall what he really knows quite well, always owes his difficulty to the blockage which is being effected by the activity of some rival desire.

Another instance of the work of rival complexes is given by the hindrances which an individual may experience when he is trying to report a series of events in the order in which they actually occurred, for the tendency is always to tell what interests the self from the point of view of the self, and to let the listener follow as best he can. Here is a case in point: An excitable girl of nine and a half had been to the theatre, and had enjoyed herself thoroughly. When she came home, she was anxious to tell me all about it. But she could not do it. After a few minutes she realised that she was not giving me the scenes in the right order, and broke off with: "No, that happened right at the end. It is all wrong. I must start again." The second attempt was somewhat better, but presently she lost the thread once more and exclaimed: "That's wrong again, but I'll get it right this time." And even at the third attempt she had to go back a few times to explain points she had omitted. The

difficulty which the child experienced was clearly due to the activity of rival complexes. She wanted to tell me the story so that I could follow it properly, but that involved the temporary suppression of the most exciting part, and that was just what she could not do. This is a normal stage in the development of children, but adults also do not find it easy to report a series of events in their proper sequence, when the emotional element is at all strong.

Another thing which we find difficult for the same reason is to give a straightforward answer to a straightforward question. Often the question as such is concerned with matter which is of little interest to us. If so, ecphory is correspondingly weak and rival complexes are therefore liable to produce all kinds of irrelevant material—particularly reminiscences and anecdotes. The person who has learnt to consider the desires of others usually blocks these side-thoughts as they occur. But the person who has retained his infantile belief in his own importance often finds it impossible to realise that these interesting experiences of his own are at the moment less important than the uninteresting fact which he has been asked to supply. And such a one will, therefore, often compel his unfortunate listener to follow him through a long account of his own acts and thoughts before he produces his one grain of useful information.

Individuals who find expression for their love of self in this way have often been caricatured in

literature. A classical example is that of Miss Bates in Jane Austen's *Emma*.

Miss Bates is the daughter of a former vicar of Highbury, a large and populous village. Her youth has passed without distinction, and her middle of life is being devoted to the care of a failing mother and the endeavour to make a small income go as far as possible. And yet she is a happy woman—a woman no one named without good will. She thinks herself a most fortunate creature, surrounded with blessings in such an excellent mother and so many good neighbours and friends, and a home that wanted for nothing She is continually impressed by the kindness of her friends who supply her with the little comforts of life to which she had been accustomed in her youth She is "so obliged to them" when they call on her, "so pleased" when they appreciate her cooking. If we add to this that she never boasted either beauty or cleverness, and that her constant companion, her mother, is at the time when the story opens "a very old lady almost past everything but tea and quadrille," we see how often Miss Bates would be hurt by the limitations of her life, if she had not found a way of hiding them from herself. For, though not clever, she is not stupid either; she manages her little home efficiently, and is "quick-sighted to everybody's merits." Such a woman must find a means of holding the attention of others, if she is to

save herself from discontent. Miss Bates finds two —excessive interest in other people's affairs and the trick of turning every conversation in such a way that she becomes the centre of it.

I quote her reaction to the discovery that Mr. Knightley had forestalled her in giving Emma an exciting bit of news, and that too when Emma had just made her a present of a hind-quarter of pork which had "quite overpowered" her.

"'But where could you hear it?' cried Miss Bates, 'where could you possibly hear it, Mr. Knightley? For it is not five minutes since I received Mr. Cole's note—no, it cannot be more than five— or at least ten—for I had got my bonnet and spencer on, just ready to come out—I was only gone down to speak to Patty again about the pork. Jane was standing in the passage—were you not, Jane?— for my mother was so afraid that we had not any salting pan large enough. So I said I would go down and see, and Jane said, "Shall I go down instead? for I think you have a little cold," and Patty has been washing in the kitchen. "Oh, my dear," said I—well and just then came the note. A Miss Hawkins—that's all I know. . . .'"

William James seems to look upon redintegration of this kind as a form of stupidity. As the reader will have gathered, I feel inclined to agree with Emma, who describes it as "silly." It is the behaviour of the ostrich which hides its head at the approach of danger—it deceives no one but herself.

James sees this side of the picture too, though he apparently thinks it is only true of occasional lapses into redintegration. After giving the passage I have just quoted he adds: "But in everyone of us there are moments when this complete reproduction of all the items of a past experience occurs. What are those moments? They are moments of emotional recall of the past as something which once was, but is gone for ever—moments the interest of which consists in the feeling that our self was once other than it now is. When this is the case any detail, however minute, which will make the past picture more complete will also have its effect in swelling that total contrast between *now* and *then* which forms the central interest of our contemplation."[1]

For the more fortunate of us this acute feeling of inferiority is the exception, for the Miss Bates of this world it is the rule. That is, so far as I can see, the only difference. Miss Bates herself is on one occasion described as "too happy even to be voluble."

II. Involuntary Recall

Voluntary recall is the recall of material in response to a felt need of the conscious self. Involuntary recall, on the other hand, is from the point of view of the conscious self an independent

[1] W James, *Principles of Psychology*, i, p 571.

phenomenon which serves no kind of useful purpose.

Why do some thoughts come up again and again when they have nothing to do with the matter in hand? It may be a foolish act or a small victory, a rhyme or a snatch of song. whatever it is, it seems to pursue us for the time being. And then suddenly it vanishes as mysteriously as it came. There is, too, the corresponding problem with regard to what we forget. Why do we cease to think about things that once filled our minds? And why do we sometimes forget facts so completely that we do not even recognise them as familiar when we come across them again? It would not be correct to assume that there was necessarily a lack of sufficient interest at the time. There is the picnic that was spoilt by a thunderstorm; it cost us many a childish tear. Or, again, the deed that won us the respect of a dreaded rival, that too occupied our thoughts continually for a while. Yet we never think of either to-day; we may even find it difficult to believe them when a friend tries to call them to mind. And in contrast to this there are other scenes which must have made less impression at the time which still crop up in consciousness years after they occurred. In cases such as these the conscious self seems to be at the mercy of forces which are quite beyond its control. The feeling is that such thoughts come from nowhere, that they stay as long as they choose, and that the

conscious self is just a helpless spectator. These are the problems which will occupy us for the remainder of this chapter.

We will suppose that an individual has had an experience which is of serious emotional interest to his conscious self. That experience may have been pleasurable or painful. If it was pleasurable it removed some obstacle to the free functioning of the self, if it was painful, it blocked some customary outlet. But whether pleasurable or painful its immediate result must have been in the nature of a check to certain habitual activities of the self. The person who suddenly becomes rich has no longer any need to economise, the person who suddenly becomes poor has to learn to do without many things. But different as their new problems are in many respects, they are alike in this, that both necessitate new reactions to familiar stimuli In the one case certain forms of self-denial have become unnecessary, in the other, certain forms of self-indulgence have become impossible. And as we know from experience every incident which forces a new adaptation upon us is at first liable to remind us of the change we have had to make in our outlook on life. In terms of the engram theory, this means that the energy which is set free by the stimulus-set has found the path to the customary reaction blocked by the ecphory of the new configuration, and that the effect of this blockage has been the involuntary recall of the

event to which that configuration owes its existence. From the point of view of the immediate present the vital part of the process is clearly the blockage, for it forces the individual to adopt a new form of behaviour. But from the point of view of the future the recall has an equally important function to fulfil. We have already seen that an engram-set can only be incorporated within a system of the conscious self, if the corresponding stimulus has been perceived by the self at a time when that system is ecphoring.[1] Events which are of importance to the welfare of the self will have to be incorporated into a number of its systems, but the events themselves are often of such a nature that they cannot recur. It would therefore be impossible to incorporate them within all the relevant systems of the self, if it were not for the tendency towards involuntary recall which enables the individual to "reperceive" events, and thus make the necessary associations possible in spite of the Law of Mutual Blockage.

However, blockage is not adaptation it only checks the customary reaction; it does nothing to provide an alternative. Yet it is clear that some outlet has to be found for the energy which is set free by stimulus-sets. At times, a great shock may leave an individual so exhausted that he is incapable of adapting himself to the change. He finds it easier to live in the past and uses the energy that

[1] Cf. Law of Mutual Blockage, p 45

is set free by thinking over the event which led to the disaster and all that is connected with it. Or again, the mechanisms which produce involuntary recall may cease to function normally and the individual may begin to live in an imaginary world of his own, inventing equally imaginary reasons for such adaptations as he is forced to make. Such is the case of the girl who is incapable of facing the fact that her lover was drowned at sea and who waits for him year after year, inventing one reason after another for his continued absence. However, these cases are fortunately rare. As a rule the urge to live in a real world among real people presently regains the upper hand. Then a struggle for adaptation ensues. At first every relevant stimulus-set produces blockage and consequent recall. But presently new paths are found; some things are given up, others take their place. There is less blockage and consequently less involuntary recall, until in the end the event itself but rarely becomes conscious of its own accord, because it rarely interferes with the activities of the individual.

Incidentally, we can now also understand why a painful experience is usually more difficult to forget than a pleasant one of the same intensity. An experience is painful when it forces an adaptation on the individual against the will of the conscious self, pleasurable if it removes some obstacle to the free function of the conscious self. Hence a painful experience must necessarily cause more blockage

and consequently more involuntary recall than a pleasant one.

What we have said so far does not explain why we should be liable to have tunes or rhymes pursuing us, or why we should suddenly find ourselves thinking of a scene which never had any emotional associations for us. Experiences such as these usually remain inexplicable until we apply the Method of Free Associations, but when we do this we find that they too have a definite function to fulfil. An example will show what I mean. A certain Mrs. B. had an experience which badly hurt her love of self and made it necessary for her to adapt herself rapidly to various changes in her environment. Needless to say, the experience caused blockage at every turn, and the thought of it seemed to pursue her day and night. Being a strong-willed woman, she did her utmost to forget all about it, and to make the necessary changes in her customary reactions. But, as we have seen, this is a matter which takes time. There is certain to be frequent blockage and consequently frequent recall until the new forms of behaviour have become fairly habitual. This is exactly what Mrs. B. found. Do what she would she could not banish the unwelcome thoughts from her mind. Then one morning, she woke up with a cheerful tune running through her head. Very pleased with herself, she decided that she had "got over it at last," and she certainly felt more energetic and more

able to take an interest in other things. Presently she found that the tune was recurring again and again. She began to wonder when she had heard it before, but could not locate it. However, the words gradually came back, and she then realised that it was a nursery rhyme which she had probably not heard for fifteen or twenty years. This aroused her curiosity. She began to examine the words as such. Then she saw in a flash that the little rhyme presented symbolically the very situation which was giving her so much trouble at the time. It had acted as a safety valve for energy of which she was not able to dispose by other means, and the relief she had experienced was due to the fact that she had been able to find this outlet. In this case the origin of the tune was easy to discover, because the suppressed element was so near the surface of consciousness. In other cases psycho-analysis may be needed to reveal it. But when the investigation is carried far enough, it is always found that the idea which seems so purposeless is really a safety valve for some complex which has been suppressed or repressed. It would seem then that blockage normally produces involuntary recall, but that that recall may in turn be blocked by the conscious self, and that the result may then be the recall of some other thought which acts as a symbol for the one which is being suppressed.[1]

[1] This is, of course, not the only thing that may happen, but it is the only one which concerns us here.

We have so far only considered experiences which necessitate important adaptations. Experiences such as these are never forgotten in the sense of being beyond voluntary recall. They cease to recur in consciousness of their own accord once the necessary adaptations have been made, but they can always be reproduced at will.

We shall now turn to a class of experiences which tend to disappear in such a way that they are no longer at the disposal of the conscious self, experiences which we cannot recall at will and may not even recognise when they recur. As we have seen, such forgetting is at times due to the activity of the rival complexes, but these are in the minority. In most cases there is no reason to suppose that the path to the material has been blocked by the activity of another complex. We forget many of the facts which we learn at school, many of the books we read, and many of the people we meet. On the whole, the things which we forget are the things which did not interest us particularly at the time, but that is only one side of the problem. The other seems to be that we tend to forget things when we no longer need them. The more carefully we learn a fact, the longer will it remain part of our available stock of knowledge, but if we do not use it, and if it does not happen to form a symbolic outlet for some complex or other, then even a fact that was quite familiar will gradually become more and more difficult to recall, until it is ultimately

forgotten altogether so far as the conscious self is concerned. Yet it must not be imagined that there are no traces left. As Ebbinghaus has shown, there is always some saving of time in re-learning material even after an interval of many years.

It would seem from this that engram-sets never disappear entirely, but that the readiness with which they produce awareness within a given system depends on the frequency with which they respond to a felt need of that system. The survival value of this is obvious. On the whole the engram-sets which are ecphored most frequently are the ones which are most likely to serve the purpose of the individual on any given occasion, and, thanks to this tendency, they are also the ones which most readily produce conscious awareness. In other words, we tend to think of solutions to our problems in order of their probable value. Those which serve our purpose most frequently are also the first to be recalled, whereas those which we use rarely only become conscious when the others have failed to satisfy our needs, and those which merely owe their present incorporation within the system to the fact that they had their uses in the past are, as a rule, simply forgotten.

CHAPTER VIII

CONSTRUCTION

We have seen that the presence of an obstacle to the free functioning of the self normally produces a desire to remove it. As a rule familiar forms of attack are tried first, but, if these fail, the individual of normal intelligence often succeeds in discovering some new, original method of attaining his end. The form of behaviour which results from such an effort we shall call a *construct*, or, if the individual becomes aware of it as an idea, a *mental construct*. The act of forming a construct may be conveniently called *an act of construction*, and the power of the mind which renders construction possible its *constructive power*.

In the literature of the subject the constructive power of the mind is usually called the imagination. This term is, however, so closely associated with the idea of image-making that it is liable to lead to confusion of thought, and it seems better, therefore, not to use it in our discussion. The term constructive power has the advantage of suggesting the power of evolving new forms of behaviour without implying any connection between this power and

the tendency to become aware of ideas in the form of images.

I shall begin the study of construction by giving an example from my own experience.

On a certain occasion I was asked to see what was the matter with the door of the coal house which would not close properly. Assuming that a bit of coal must have got lodged under the door, I went with some annoyance to see what was wrong. Observation showed that there was nothing on the ground to account for the difficulty. Swinging the door open, I found that the hinges were also in perfect working order. I was thoroughly puzzled. Then, suddenly, I found myself staring at the door-post and saying, "Look, the door-post has split, no wonder the door won't close." As a matter of fact the door-post had split down beyond the level of the upper hinge, and as there was no horizontal support, the door had consequently been thrown out of the vertical. But I had not consciously perceived this when I went to look at the door. So far as the conscious self was concerned, I saw the split for the first time when I realised that it was the cause of the obstruction.

What happened was probably somewhat as follows: Thanks to previous experience an obstacle on the ground and a broken hinge suggested themselves immediately as probable causes, but when neither of these proved of any use, I had to realise

that this was a situation which was in some way new to me. And then came the interval during which I was only aware of not knowing what to try next. Consciously I had merely put aside the broken hinge as a wrong solution when I let the door swing back into its former position, but, owing to the annoyance at being defeated by what seemed such a simple problem, there was evidently sufficient energy produced to cause the ecphory within the engram-set "broken hinge" to spread through "conditions which throw the door out of the vertical" to "broken door-post." The ecphory of this new engram-set must then have produced an impulsion to look at the door-post and the consequent solution of the problem. In other words, the energy which was blocked at "broken hinge" managed to find another outlet in "broken door-post," but consciously I was aware of none of this. All I realised was blockage followed by awareness of the cause of the obstruction and a distinct feeling of relief. The process by which the desired solution was obtained remained unconscious from beginning to end.

This is, of course, in accordance with general experience. If we think of a new way of tackling a difficulty, we say "it has just struck me that . . .", if we can't solve a problem, "I'll sleep on it, perhaps it will come to-morrow", if we see someone else succeed where we have failed, "I never hit upon that." Always the predominant

note is one of irresponsibility on the part of the conscious self.

In short the solution of a problem comes upon us as unexpectedly and as unaccountably as the dream image and the phantasy. Moreover, it comes to us for the same reason, for it too is a safety valve for energy, which cannot take its natural path. In the case in point my object was to close the door. I was not strong enough to force the door, so the most primitive form of reaction was blocked at once. There were two other familiar paths available, both were tried and both only produced further blockage. Then came the moment of bewilderment, during which the energy was evidently trying to find a new outlet, and then the awareness of the construct "broken door-post" with its accompanying feeling of relief.

In the dream, the only difference is that the desire itself is taboo and is, consequently, incapable of producing awareness of its existence. Thus the child who dreamt about the little boy who was sitting at a table trying to solve a problem, had no idea why this picture should occur to her, and it was only with the aid of psycho-analysis that she discovered that the dream was an outlet for her suppressed desire for sex instruction.[1]

We may sum this up as follows When a desire is inhibited in such a way that the impulsions to which it gives rise can take none of their customary

[1] Cf p 63

paths, these impulsions may at times find a new outlet which is not blocked, and it is this new outlet of which the individual tends to become aware as a mental construct.[1]

We have seen that an individual normally resorts to his constructive power under the influence of a pressing need. We now want to get an insight into the process as such. To do this it will be convenient to examine cases in which the solution is either not obtained at all or only after a number of false attempts. Moreover, we shall want the problem itself to be as simple as possible, so as to minimise the chance of misinterpretation, and shall want the solution to take place under experimental conditions so as to have all relevant facts at our disposal All these conditions are given in the interesting experiments which Kohler conducted with chimpanzees at the anthropoid station at Teneriffe, the results of which he published in a book which has now been translated into English under the title of *The Mentality of Apes*. Of the many instances of problem solving which are given in this book, I choose one which shows the difference between the behaviour of the intelligent "Sultan" and the much less gifted "Rana."

"Sultan is squatting at the bars, but cannot

[1] We have already seen that new outlets may be of the nature of impulsive acts of the existence of which the conscious self is not aware, cf p 54

reach the fruit, which lies outside, by means of his only available short stick. A longer stick is deposited outside the bars, about two metres on one side of the objective, and parallel with the grating. It cannot be grasped with the hand, but it can be pulled within reach by means of the small stick (see Fig. 7).

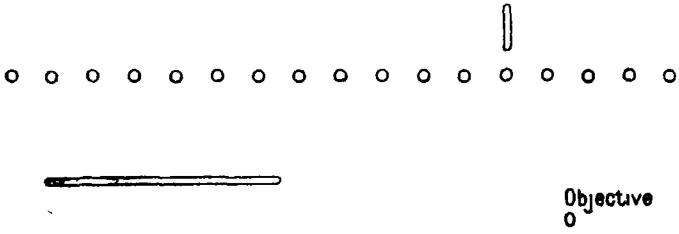


FIG 7

Sultan tries to reach the fruit with the smaller of the two sticks. Not succeeding, he tears at a piece of wire that projects from the netting of his cage; but that, too, in vain. Then he gazes about him; (there are always in the course of these tests long pauses, during which the animals scrutinise the whole visible area). He suddenly picks up the little stick, once more goes up to the bars, directly opposite to the long stick, scratches it towards him with the 'auxiliary,' seizes it, and goes with it to the point opposite the objective, which he secures. From the moment that his eyes fall upon the long stick, his procedure forms one consecutive whole, without hiatus, and, although the angling

of the bigger stick by means of the smaller is an action that *could* be complete and distinct in itself, yet observation shows that it follows, quite suddenly, on an interval of hesitation and doubt—staring about—which undoubtedly has a relation to the *final* objective, and is immediately merged in the final action of the attainment of this end goal."[1]

The behaviour of Sultan is evidently just like that of a human being, who is faced with a problem he cannot solve at once. When he finds the stick inside the cage is of no use to him, he gazes round in doubt, and then suddenly does the right thing without further hesitation In the course of the book Kohler points out again and again that a case like this is one of genuine problem solving. Sultan does not fumble about vaguely until he happens to hit on the right set of movements He stops, he hesitates, then suddenly he knows what has to be done.

It is for this reason that failures to solve the problems are so instructive for our purpose.

Rana, when she was tested in her turn, found the problem too much for her. Kohler says "Clumsily, she angled with the auxiliary, and then approached the larger and stretched her hand *out towards it.* Her whole behaviour could thus be expressed in human speech 'I shall not reach the objective with the little stick—outside there is a long stick which my hands cannot reach.' She did not for

[1] *Op cit*, pp. 180–1.

an instant seem to *see* the auxiliary stick (which is, as it were, inseparable from the objective) as an instrument for securing the longer stick. Finally, I gave her some assistance. In order that she might with greater ease connect the little stick with the long one, I pushed it away from the objective, and nearer to the big one, while Rana was looking in another direction. I continue this till the small stick is quite close to the big one. *Nevertheless, as soon as Rana had seized the short stick, she hastened back to the bars, just opposite the fruit,* and angled for it with the totally inadequate bit of wood. The detour 'short stick – long stick – fruit' simply does not arise with this animal She reminded me of the hens, that often charged straight at the wire-netting in front of a coveted morsel, although a very short 'way round' would have brought them to it at once, just in the same way, Rana scrapes and stretches vainly towards the fruit which she could have secured with so much less exertion. It almost seemed as though the short stick were attracted by an unseen but strong force into the primary critical direction 'goal – bars,' and therefore does not come into consideration at all for the secondary distance 'long stick – bars'"[1]

The behaviour of Rana shows clearly where her difficulty lay. The animal realised that she could get the fruit with the short stick and she had many a time dragged fruit within her reach by means of

[1] *Op cit*, pp 182–3.

a stick, but the fact that she could drag in the long stick with the short one was the new element in the situation which she failed to discover. The new link that she had to establish was stick inside–stick outside, and it was this that proved beyond her power. Yet the common element was there right enough. "Fruit outside" produced an immediate search for a stick; "stick outside" only produced an attempt to reach it with the hand. The common link was "object outside"—that is to say, the fruit outside had to ecphore "outsideness" apart from edibility. If it had done that whilst Rana was trying to get the long stick which was clearly "outside," then the new linkage "short stick–long stick" would probably have been achieved

But there is another factor involved. We see Rana trying the primary solution over and over again, until it becomes a sort of obsession from which she cannot free herself. She seems unable to inhibit the act in spite of its proved uselessness. Sultan on the other hand makes one attempt with the short stick. Then he looks round for something else, and when the bit of wire which he has torn from the netting also proves too short, he gives that up too and gazes round instead. In other words, he promptly inhibits impulsions which do not lead to the desired end. If he were a human being, we should say he "sits and thinks" instead. It is no doubt this tendency to inhibit useless

impulsions which accounts in part for his superior ability, for it drives the energy back to produce further ecphory within established engram-sets, and thus increases the chance of finding a path which will lead to better results.

It should be noticed that the inhibition which is here involved is something quite different from voluntary self-control. Introspection shows that we *find ourselves* stopping, wondering, or, if we persist when no new ideas will come, repeating to our own annoyance attempts which we know quite well to be useless. In fact the experienced worker usually breaks off his efforts when he can do nothing better than repeat useless acts or thoughts, for he knows quite well that he cannot force solutions by mere persistence. The tendency to inhibit useless impulsions would in fact appear to be inborn, unconscious and unwilled. In watching the behaviour of an intelligent and an unintelligent individual the impression is that the latter is endowed with a more sensitive mechanism, one in which failure blocks the outlet more effectually and consequently forces the energy to take another path.

We become aware of the problem which is to be solved and of the desire to solve it. Then follows a state of inhibition during which there may be a flood of useless ideas, or only a feeling of blankness or bewilderment. And then finally, after a longer or shorter interval, come the awareness of a possible solution with an impulsion to try it.

As will be seen later, we can help ourselves to a great extent by making conditions as favourable as possible, but in the end we are always at the mercy of our inborn powers and have just to wait until they produce something serviceable. However, if a worker really wants to solve his problem, the relevant configurations will continue to ecphore whilst the conscious self is otherwise occupied. Sometimes the solution will come upon him suddenly when he is not thinking about the problem at all At others he will at least find that the next day brings fresh ideas which are worth trying. But whatever happens the one thing that is certain is that we cannot force ourselves to find a solution in a given time If we persist in our efforts after new ideas have ceased to come, the energy is inevitably driven into more primitive paths, and all we derive from our determination not to be beaten is either an outburst of anger or an "obsession" to try again and again what we have proved to be useless.

If the reader will forgive a crude analogy, we can liken the constructive process to a railway journey by thinking of the acquired engram-sets as a network of railway lines and the energy as a train which travels over them. Then the familiar act is the journey which has been taken many a time, the new act the journey which is being taken for the first time. To succeed in the latter it is necessary both to inhibit the desire to take the old familiar path and to find the junctions which

will lead to the desired spot. Finally the junctions must be in existence, otherwise it will be impossible to take the new path, and the journey must appear worth while, otherwise it will be more comfortable to stay at home. In other words, the constructive process would seem to involve (1) a fairly strong desire to attain an end which cannot be satisfied in the customary manner, (2) the previous experience which provides the necessary connecting links, (3) the inborn power to inhibit impulsions which have proved useless without losing the desire to attain the end, and (4) the inborn power to make use of paths which have so far only had a potential existence.

Of these four the last two determine what is often called the *intelligence* of an individual. We may say, then, that intelligence consists in a tendency to inhibit acts of proved uselessness combined with the power of finding new paths for the energy which has been set free. These factors are both inborn and can probably only be influenced indirectly by the provision of good hygienic conditions more particularly during childhood and adolescence. They vary greatly from individual to individual: the intelligence tests which are now being applied with continually increasing success have placed it beyond all doubt that of two persons, who are both in possession of all the relevant data, one may solve a given problem easily whereas the other has to give it up as hopeless.

Important as intelligence, knowledge, and the absence of hindering inhibitions are in original constructive work of any kind, an individual may have all these to a sufficient degree and may yet fail because he does not know how to use what he has got. In other words, method is at least as important as power and knowledge, and the less gifted person may succeed when the more gifted fails simply because he knows how to set about his task.

In practice every type of work has its own particular methods of attack which have been discovered by other workers and can therefore be acquired by the learner with very little constructive effort on his part. He can be shown that the easiest way to invent a geometrical construction is to work from a rough figure which puts before his eyes the sub-problems which the construction involves. He can be taught how to use a microscope or a paint-brush, how to obtain information out of a book, and what series of questions he should put himself, if he wants to ascertain the name of a particular flower or the derivation of a particular word. To discover such points of special method often requires a high degree of intelligence and much time and effort, but to learn them from another is frequently a simple matter which is well within the scope of the ordinary person of average ability.

In addition to the special methods which vary from

subject to subject, there is also what may be called general method because it applies to investigations of all kinds. This general method shows itself in the attitude of the worker toward his problem. As a rule the beginner rushes wildly at his obstacles or, if he does stop to think, the inhibition comes from within and is, so far as one can judge, similar to that which Kohler observed in his chimpanzees.[1]

The experienced worker, on the other hand, plans a difficult investigation with as much care as a general plans a campaign against a formidable enemy. Moreover, once he has set to work, he keeps a careful record of all that happens in case he may need it later and is at any moment prepared to revise his plans or to recast them as necessity arises All this the beginner has to learn, and without it the possession of the necessary knowledge and intelligence may be of very little use to him.

In this connection it seems worth while to quote an experiment which the writer once tried upon a class of picked scholarship children who were between eleven and twelve years of age. The object of the experiment was to ascertain how much help the children would need to discover the law of moments for a lever which has its fulcrum between two arms of equal length. The children were given levers with graduated arms, were reminded of their similarity to see-saws, and were shown that a heavy weight placed near the fulcrum on one arm

[1] Cf. above, p 164.

could be balanced by a lighter weight placed at a greater distance from the fulcrum on the other arm. After having been left to prove that this is true with any combination of weights, they were told that it was possible to foretell where a given weight must be placed on one arm to balance a weight which has already been placed in position on the other arm, and that the determination of the right position depended on some relation between the values of the weights and their distances from the fulcrum. It was then suggested to them that they should try to discover this relation. They were all keenly interested in the problem. All the same, not one child discovered the law.

In the following lessons the problem was gradually made easier for them They were told to keep one weight fixed, to write their results down, and so forth. But it was only when they were definitely told to place a given weight in a given position on one arm and to see where other given weights would balance it on the other arm that three or four out of a class of thirty thought of multiplying each weight by its distance from the fulcrum. For the others the problem was still too difficult As a matter of fact those who did discover the relation only saw it because they had been given weights and distances which involved no fractional parts. In reality they all failed, for not one of them thought of attacking a particular numerical result systematically to see what relations it might suggest. Yet

all these children were very quick at number work. They failed neither through lack of ability nor through lack of knowledge, but simply and solely because they had not yet learnt the wisdom of planning a systematic attack when the solution of a problem is not obvious

In our daily life it is of course often the way in which an attack is planned which decides its success or failure. This planning is once again an act of construction, but it is more exacting than those which we have considered so far because it necessitates more conscious control. The person who has invented a concrete tool can as a rule test its efficacy on a small scale on waste material before he uses it in a task in which failure would mean disaster, but a person who plans an equally important line of action can rarely leave it to actual experience to teach him where his scheme will have to be altered, if it is to prove serviceable. In the vast majority of these cases experiment is excluded by the very nature of the problem, and the whole process has consequently to be carried out in thought alone, the act which tests its value being the only and the final act. Anyone who is fond of chess is familiar with the mental state which this induces and with the way in which obvious counter moves are at times overlooked.

To plan an action and to foresee its results requires in the more complex cases absence of

hindering inhibitions and fearless self-criticism as well as the necessary self-confidence, knowledge, and intelligence. It is one of the essential qualities of a leader—more particularly of a leader at a time of crisis. This is shown very clearly in Trotzky's character sketch of Lenin. "The human imagination," says Trotzky, "may be of many kinds: the constructive engineer needs it as much as the unrestrained fiction writer. One of the most precious varieties of imagination consists in the ability to picture people, things, and phenomena as they are in reality even when one has never seen them. The application and combination of the whole experience of life and theoretical equipment of a man with separate small stopping-places caught in passing, their working up, fusion, and completion according to definite formulated laws of analogy, in order thereby to make clear a definite phase of human life in its whole concreteness—that is imagination, which is indispensable for a law-maker, a government-worker, and a leader in the time of revolution. The strength of Lenin lay, to a very important degree, in the strength of his realistic imagination. In particularly critical moments, when it was a question of a very responsible or risky tactical change of position, Lenin put aside everything else less important that permitted postponement. . . . He (then) had before his eyes the problem that he considered could not be postponed in all its concreteness, took hold of it

from all sides, studied the details, now and then even secondary ones, and sought a point of attack in order to approach it anew and give force to it—he recalled, expounded, emphasised, controlled, and urged. But all was subordinated to the 'links of the chain' which he regarded as decisive for the moment in question."[1]

[1] *Lenin*, by Leon Trotzky, pp. 172–3.

CHAPTER IX

INTERPRETATION AND RECONSTRUCTION

In the present chapter we shall be concerned with the type of problem solving which arises out of the desire of the individual to understand his environment. Such a desire may be induced by what is actually happening at the moment or by an effect of which the cause is not known. In the former case the solution of the problem depends on an act of interpretation, in the latter on an act of reconstruction. If I watch a boy pour pail after pail of water into a hole which he has dug, I interpret his act as an attempt to make a pond. If I find a muddy-looking hole with children's spades and pails near it, I reconstruct a scene in which one or more children were trying to make a pond by pouring water into a hole. Thus interpretation and reconstruction both increase our knowledge of our environment. Besides this an act of interpretation may also lead to an increase in power either by teaching new methods or by suggesting the necessity of acquiring new forms of skill. As the mental processes are somewhat different in the two cases, it will be convenient to consider them separately.

Interpretation

At times we feel that the person we are observing is trying to attain a familiar end by familiar means. At other times either end or means may fail to suggest any previous experience of our own. In the latter case we are faced with a form of behaviour which seems purposeless until we have discovered the function of the different parts in relation to the whole; that is to say, until we have interpreted the unknown in terms of the known. Thus the interpretation of an action consists in the solution of the problems which arise out of our efforts to understand it, and its comprehension in the awareness of the fact that each part of the process which we are witnessing has an obvious bearing on the rest, and that there are consequently no unknown factors in the situation. Successful interpretation will therefore lead to the complete comprehension of an act which before seemed more or less meaningless.

The reader will see that the process of comprehension is in many ways similar to that of perception. Just as I understand a familiar form of behaviour, so, too, I perceive familiar stimulus-sets without being aware of the process to which I owe my knowledge. I look out of the window and find myself thinking that it is windy to-day. What has happened is that the swaying of the trees and bushes has ecphored a well-established configuration of

which I become aware as "windy," but the process has been entirely mechanical. In the same way, if I see a ball lodged in the branches of a tree and a boy scrambling up its trunk, I assume that the boy is trying to get the ball and understand his behaviour in terms of that end. In this case, too, previously established engram-sets are ecphoring and my comprehension of the situation is immediate and mechanical. In fact, the only difference between perception and comprehension seems to be that perception depends on the ecphory of a comparatively simple configuration in response to a single stimulus-set, whereas comprehension depends on the ecphory of a more complex configuration in response to a series of stimulus-sets. I *perceive* the boy in the act of climbing the tree, I *perceive* the ball lodged in its branches, but I *understand* what the boy is doing, namely, that he is climbing the tree in order to get the ball.

Under suitable conditions we seem to be able to acquire configurations of great complexity and use them with great success. In his own subject the scientist understands long technical discussions and sees without difficulty the bearing of each step on the point at issue, so long as the facts which are put before him do not necessitate the establishment of new links or the modification of existing configurations. For the problem with which he has to deal ecphores a highly complex configuration within which each of the different steps is already

represented by the corresponding minor configuration.

Whilst comprehension is thus similar to perception, *interpretation would seem to correspond* more nearly to recognition We saw in Chapter VI that recognition involves the solution of the conscious problem, "How is this stimulus-set to be classified in relation to the interest of the moment? Is this flower one of the labiates? Is that person the friend for whom I am waiting?" In interpretation the problem is the same, but the interest centres round a series of stimulus-sets, such as that which is presented by the actions of another, with the result that the configurations which are involved are far more complex, and the solution of the problems which become conscious is consequently far more difficult.

Since comprehension and interpretation both depend on the ecphory of previously established configurations they are both liable to be influenced by the main interest of the moment, and by the preconceptions of the observer. If we see a confirmed drunkard entering a public-house we come to one conclusion, if we see a detective entering it, to quite another, though as a matter of fact the data at our disposal do not warrant a conclusion in either case. Another danger is expressed in the old saying, "give a dog a bad name and hang him. If we expect a person to do wrong, that will necessarily form part of the configuration which ecphores

when we see him engaged in any form of activity, and will consequently affect the meaning we put into it. Hence the fact that we feel we understand what another is doing does not prove that we have actually understood him, and the stronger one's emotional attitude the more reason has one to suspect the correctness of one's conclusions.

Beyond this comprehension need not detain us further at this stage Its success depends, as we have seen, on the possession of the necessary knowledge, and the absence of undue prejudice. These are factors which it will be more convenient to consider in a separate chapter (cf. The Growth of Configurations) For the rest of this chapter we shall therefore confine our attention to the special problems which arise in connection with the act of interpretation

So long as we only wish to imitate the behaviour of another in phantasy, all that matters is that our interpretation should satisfy our own needs Hence our problem is comparatively simple We can ignore what we do not need. We can misinterpret or add to our heart's content Only when our enjoyment is spoilt by the mistakes we make do we need to investigate what the other really meant by what he was doing Novel-reading is a good example of the kind of occupation which leads to this sort of interpretation, and of the way in which concrete facts at times force us to realise that we have allowed ourselves too much liberty. A reader

may, for instance, feel that the behaviour of one of the characters in his novel is quite inconsistent with what the earlier description of that character had led him to expect; yet, on re-reading the first part, he may have to decide that the character drawing is sound enough, and that it was his own interpretation of what he read which was at fault. Or again, he may decide that the illustrations in a book are wrong, to find on examination that they are quite correct so far as the description of the author is concerned, and only fail from his point of view because they do not give the additional touches which he has involuntarily added to complete the picture to his liking.

When we turn from phantasy to reality, the interpretation of a new form of behaviour is far more difficult, for it has as a rule to stand the test of experience; that is to say, it has to enable us to overcome obstacles which no amount of wishing will ever alter. In its complete form such an act of interpretation must lead to a clear realisation of the purpose of the demonstrator, and of each of his acts in relation to that purpose. In practice we are, however, often satisfied with less. Once again we only interpret enough to satisfy our end, and as we know from the way in which we tend to accept conventions and fashions this is at times very little indeed. Behaviour of this kind is of course due to the combined action of mass suggestion and prestige

suggestion, and so long as it only makes for uniformity in non-essentials it probably does more good than harm. But in practice, desire for the approval of comrades and superiors often leads to the acquisition of masses of facts which are meaningless to the individual, and are only "learnt" for the sake of the privileges they carry with them Thus one boy will memorise a geometry theorem which he does not understand in order to get as many marks as his neighbour, and another will learn the translation of his Latin set book by heart in the hope of passing an examination in that subject. In such cases a teacher will often try to influence his pupil by pointing to the uselessness of the work which has been produced. But as a matter of fact the work is not useless from the point of view of the worker, so long as it secures him the signs of approval for the sake of which it was undertaken. If the geometry theorem and the book of Livy are to rouse a desire for true interpretation the only thing to do is to present them to the pupil in such a form that he is led to think of them as problems which are worth solving for their own sake, not as magic formulæ which only differ from the "please" of the baby in that they are more difficult to imitate.

It seemed worth while to make this digression because mechanical reproduction often looks like interpretation until it is examined more closely. In what follows we shall only be concerned with definite attempts to understand what is being done.

We will begin our study of the complete act of interpretation by examining the processes which are involved in the solution of a geometrical problem. We will suppose that a boy has been told to construct a triangle ABC in which the angle A = 60°, the side AB = 2 cms, and the sum of the other two sides = 5 cms., and that he has not been able to

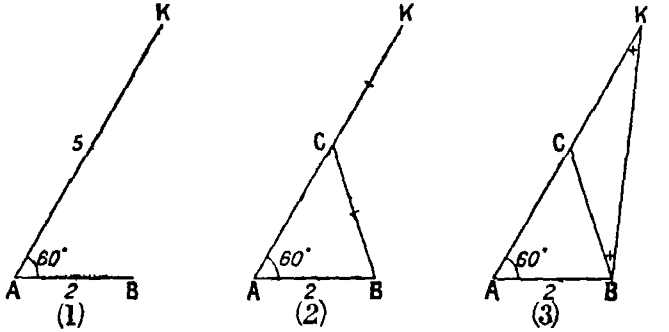


FIG 8

solve the problem by himself. Anyone who has had any experience in the teaching of mathematics knows that there are two ways of helping him. The one is to give him the right construction, and demonstrate that it is correct, the other is to lead him to discover the construction himself.

(*a*) If we adopt the first method we shall give him the following instructions: Draw a line AB of length 2 cms. Make angle BAK = 60° and AK = 5 cms. Join KB and make angle CBK = angle CKB. We shall then point out that ABC is the

required triangle and that this can be easily deduced from the fact that CB = CK. [See Fig. 8 (3).]

(*b*) If we adopt the second method we shall begin by telling him to draw a figure with the data which he is given, i.e. (1) in Fig. 8. We shall then inform him that the easiest way to solve the problem is to put into (1) a rough construction for what is wanted, and to deduce from this the proper accurate construction. With this help some pupils will be able to produce (2) by themselves, others will have to be asked such questions as " Where will the point C be when the construction has been discovered ? " before they succeed in constructing it. With the aid of (2) the bright pupil will be able to discover his own construction, others will need help to arrive at (3), others may even then fail to see how to work back from (3) to draw the triangle into (1). But in the end every pupil who is fit to do this work at all will understand exactly what he has done and why he has done it.

Of these two methods (*a*) and (*b*) the second is by far the easier for the pupil who takes an intelligent interest in his work, for it enables him to think with the demonstrator instead of being merely told what to do without any clue as to the meaning of the parts in relation to the whole If the pupils have the necessary knowledge, they will of course be able to prove that the construction which has been given by method (*a*) actually satisfies the given conditions. And if a number of similar problems are

given, the most intelligent of them may discover for themselves how these constructions can be evolved. But for the pupil of average intelligence this is far too difficult a task, for him the power to invent constructions of this nature just adds another to the many mysteries he encounters in life, and, if by bad luck he is expected to reproduce them, the only thing he can do is to resort to mechanical memorising. On the other hand, if the problem has been tackled on the lines of method (*b*) the position of the learner is quite different. It is true that he is presented with the idea of fixing the point C roughly and of using the figure he obtains in this way to determine the triangle ABC accurately. But once the method has been suggested in this way, every line that is drawn has a distinct purpose which may be discovered independently, or, failing that, will at least appear obvious when it is pointed out, with the result that the process becomes one in which the end is always clearly before the pupil, and each step is such that its value can be fully appreciated as it occurs. In short the success of method (*b*) depends on the fact that the learner is tackling the definite problem of completing Fig 8 (1) with the aid of Fig. 8 (3) and is therefore faced with obstacles everyone of which he can formulate clearly to himself, instead of being left to struggle with a desire which is too vague to suggest any definite problem. When he sets to work he will find that he can surmount some of

these obstacles by means of independent construction. With others he will need help. But, since the right configuration is ecphoring, all that is needed is to make the common link conscious. The pupil may for instance join BK in (1), and then fail to see how to determine angle CBK, but the reminder that the triangle CBK is isosceles will at once enable him to overcome his difficulty.

We see then that the interpretation of the action of another depends on two factors—(1) a clear realisation of the problem in the form in which the demonstrator is tackling it and (2) a clear comprehension of the part played by each step in the attainment of the end. Both of these clearly depend in their turn on the possession of the necessary knowledge and constructive power, but, as we have shown, the correct interpretation of the steps itself depends on a proper comprehension of the end in view.

If the demonstrator is able to explain to the observer exactly how a problem appeals to him, the comprehension that is involved is similar to an act of perception. As the demonstrator points out what he is going to do the corresponding engram-sets ecphore within the observer until he sees the problem as the other sees it, that is to say, until the configuration which is ecphoring within him is sufficiently like that of the demonstrator to enable him to perceive the obstacles the other is encountering. In such a case comprehension depends largely

on previous knowledge. If the realisation of the problem involves the formation of new links, there may be a momentary hesitation followed by either independent or interpretative construction. Thus the boy who is for the first time being shown how to solve a geometry problem on method (*b*) is quite likely to want to know what can be the good of imagining that you have already done the very thing you want to do. But a reminder that (3) is only a rough figure will help him to find his own answer. There is nothing mysterious in the process, all that is needed is to point out the link to him, if he cannot find it without such help.

In the classroom the demonstrator ought to know exactly what problem he is trying to solve, but outside it this is by no means always the case. So we have seen, an obstacle which we encounter for the first time produces ecphory within the corresponding configuration, and this ecphory causes unconscious construction until sooner or later we become aware of a possible solution. This solution is then tested in practice, and if it serves our purpose, is thereupon accepted as correct without further investigation. As this is the way in which solutions are actually discovered, it is not strange to find that the person who is showing us how to solve a problem often does not know himself exactly on what premises he bases his method. The brilliant thinker is often a poor teacher, for he sees through his pupils' problems so easily, that he is incapable of realising where their

difficulties lie, unless he has made a special study of the psychology of thinking.

But the less clearly a demonstrator formulates his problem, the more does the observer have to use his own constructive power to discover what the other is really trying to do. In an extreme case such as that of method (*a*), only the person who is familiar with the type of problem would be likely to guess that the construction must have been derived from a figure such as Fig. 8 (3). However, important as it is to have a clear idea of the way in which the demonstrator has formulated the problem to himself, this is not the only factor that is concerned in interpretation. We have seen that the formulation of the problem owes its value to the fact that it enables us to become aware of the simpler sub-problems which are actually impeding our progress. But awareness of these sub-problems itself presupposes the necessary knowledge With good constructive power and a clear realisation of the end, an individual may yet fail to interpret the behaviour of another through sheer ignorance.

I will give a definite instance

A baby of fourteen months was very fond of pushing her baby carriage along. She also loved to play with the lever of the brake, which made an exciting click every time she pushed it up or down with her little foot. On one occasion she had played with the brake and had by chance fixed the wheel, when she changed her mind and tried to push

the carriage along instead. Needless to say, it would not move. Baby got angry and pushed her hardest. The adult in charge then drew her attention to the lever of the brake, but baby took no notice of it. Finally the adult ostentatiously "clicked" the lever and showed that the carriage could now be moved. And baby pushed joyously. A few minutes later she stopped, again played with the lever, and by chance again left it in the fixed position. Then it was clear that she had learnt nothing from the demonstration, for when she tried to push the carriage again, the only effect of the resistance she experienced was a further exhibition of anger.

In this case the end was quite obvious to the child. she wanted to make her carriage go again But the lever was to her, of course, only a means of producing a new kind of sound, that is to say, the act of clicking was only enjoyed for its own sake, it was as yet in no way connected with the movement of the carriage. In other words, the demonstration of the adult did not help, because she had not yet acquired the engram-sets which would have given it the meaning it was intended to convey. In the same way, a person who knows nothing about electricity may not be able to connect an electric bell to its battery after he has been shown how to do it, because he has not the necessary knowledge to understand what the other is doing.

I add without further comment an illustration

from adult life to show once more the importance of the correct formulation of the necessary sub-problems:

"The facts now to be described occurred at Bethlehem, U.S.A., about 1900. A line of rail for trucks ran into a field alongside huge piles of pig-iron. An inclined plank was placed with one end on the ground, and the other on the side of a truck, and the pig-iron handler was required to carry a load of iron up this plank and to tip it into the truck. . . . Pig-iron was at that time not a very valuable commodity, and hence the management turned its attention to every possible method of decreasing the cost of treating it. . . . Great difficulty was experienced, however, in attempting to discover just how much pig-iron a man should shift in a given time. *Laborious calculations were made; movements were carefully studied, with at first no definite result. The failure was due to the fact that the men were assumed to be doing work only when moving a given weight of metal from one point of space to another*, and the calculations had taken into account only the actual weight of the pig-iron shifted from the pile to the truck. The time taken by a man to carry a weight had been neglected, and he had not been considered as 'doing work' so long as he stood motionless with a load upon his shoulders. As soon as this was realised the law sought for was obtained."[1]

[1] Muscio, *Lectures on Industrial Psychology*, p. 173 The italics are mine.

To sum up: The complete act of interpretation depends (1) on a clear realisation of the problem from the point of view from which the demonstrator is tackling it, (2) on sufficient knowledge to appreciate the sub-problems to which the main issue gives rise, (3) on sufficient knowledge and constructive power to solve these sub-problems either with or without the help of the demonstrator. The solution of sub-problems, again, depends on knowledge and constructive power. Neither of these is of immediate use without the other; if there is not sufficient knowledge, there is as yet no common element through which a path can be found, and if there is not sufficient constructive power, the element there is of no value, because it cannot be discovered. In the latter case help can, however, be given by making the element conscious for the learner, and thus enabling him to see the connection he could not find by himself.

Reconstruction

We have so far only been concerned with the interpretation of actions in relation to a more or less clearly defined end. I will next take the case in which the act is done before the observer arrives on the scene, and when he has consequently to reconstruct the cause of events from the traces which the actors have left behind them, instead of being able to watch them at work. These are the cases which will concern us in this section.

The act of reconstruction has, of course, formed the theme of many a novel and many a detective story. A person is found shot through the head. Did he commit suicide or was he murdered? If he was murdered, who did it and what did he hope to gain from the act? In certain moods we all enjoy stories of this kind, partly no doubt because they can be used symbolically for unconscious phantasies, but also because they provide a series of simple problems on which we can try our constructive skill, and the impulse to make or construct is, as we know, strong within everyone.

In real life the problem is, of course, far more complex than in the story in which the data are selected for us. If the reader wants to realise what reconstruction actually means in practice, he cannot do better than read or re-read some of the adventures of Sherlock Holmes from this point of view, for Sherlock Holmes' explanation of his successes and his friend Watson's description of his behaviour together give us a vivid picture of the qualities which Conan Doyle considers necessary for reconstructions of this kind. These qualifications are (1) familiarity with similar scenes, (2) the necessary technique, such as Sherlock Holmes' power to trace half-obliterated footprints, (3) absence of prejudice, and (4) good constructive power. Familiarity with similar scenes enables the observer to construct a number of possible theories in the light of his previous experience, and thus gives him definite lines

of thought to guide his observations ; the necessary technique enables him to make use of such traces as the actors have left behind ; absence of prejudice enables him to fit the theory to the fact instead of *moulding his percepts to fit his theory; and good* constructive power enables him to perceive relations where otherwise he would only have become aware of isolated facts. A quotation from *The Adventures of Sherlock Holmes* will illustrate this far more effectively than further discussion of the separate points

The Speckled Band

"'I had,' said he, 'come to an entirely erroneous conclusion, which shows, my dear Watson, how dangerous it always is to reason from insufficient data. The presence of the gipsies, and the use of the word "band," which was used by the poor girl, no doubt, to explain the appearance which she had caught a hurried glimpse of by the light of her match, were sufficient to put me upon an entirely wrong scent. I can only claim the merit that I instantly reconsidered my position when, however, it became clear to me that whatever danger threatened an occupant of the room could not come either from the window or the door. My attention was speedily drawn, as I have already remarked to you, to this ventilator, and to the bell-rope which hung down to the bed. The discovery that this was

13

a dummy, and that the bed was clamped to the floor, instantly gave rise to the suspicion that the rope was there as a bridge for something passing through the hole, and coming to the bed. The idea of a snake instantly occurred to me, and when I coupled it with my knowledge that the Doctor was furnished with a supply of creatures from India, I felt that I was probably on the right track. The idea of using a form of poison which could not possibly be discovered by any chemical test was just such a one as would occur to a clever and ruthless man who had had an Eastern training . . . Then I thought of the whistle. Of course, he must recall the snake before the morning light revealed it to the victim. He had trained it, probably by the use of the milk which we saw, to return to him when summoned. He would put it through this ventilator at the hour that he thought best, with the certainty that it would crawl down the rope, and land on the bed. It might or might not bite the occupant, perhaps she might escape every night for a week, but sooner or later she must fall a victim.

"'I had come to these conclusions before ever I had entered his room. An inspection of his chair showed me that he had been in the habit of standing on it, which, of course, would be necessary in order that he should reach the ventilator. The sight of the safe, the saucer of milk, and the loop of whipcord were enough to finally dispel any doubts which may have remained.'"

In scientific work, as well as in the affairs of every-day life, correct reconstruction often leads to discoveries of the greatest practical importance, for knowledge of the causes to which an event is due often makes it possible to control its recurrence at will. As an instance I shall give part of an account of Major Rennell's discovery of an ocean current which is given in Markham's *Major James Rennell and the Rise of Modern Geography*.

"It had long been well known to seamen that ships in coming from the Atlantic and steering a course for the Bristol Channel in a parallel somewhat to the south of the Scillies often find themselves to the north of those islands. This extraordinary error has passed for the effect either of bad steerage, bad observations for latitude, or the indraught of the Bristol Channel. But none of these reasons account for it satisfactorily Admitting that there is an indraught at times, it cannot be supposed to extend to Scilly, and the case has happened in weather most favourable for navigation and for taking observations."

Numbers of cases of shipwreck had occurred and many boats had been in imminent danger owing to the rocks to the north of the Scillies.

"All had been referred to accident and consequently no attempt had been made to investigate their causes. Major Rennell came to the conclusion that they might all be imputed to a specific cause;

namely, a current. The object of his paper was to investigate both the current and its effects, that seamen might be apprised of the times when they should expect to feel its influence."[1]

Markham points out how his previous experience and his knowledge about ocean currents enabled Rennell to solve his problem: Rennell had sailed along the coast of Spain when he was a midshipman. Hence he knew that there was a current setting round Cape Finisterre and Ortegal into the Bay of Biscay. He also knew that when a coast suddenly changes its direction, the current of water which is running along it does not alter its course with the shore, but preserves for a considerable time the general direction which it received from the coast it last ran by. These two facts enabled him to formulate the theory that there might well be a current from the Bay of Biscay continuing its course N.W. by W. from the coast of France to the westward of the Scilly Islands and to Ireland. Finally he knew from an experiment a friend had made in a canal that the strength of a current is regulated by the state of the winds, and was thus able to account for the fact that shipwrecks had occurred on occasions when the weather had been most favourable for navigation. "The current that prevails at ordinary times is probably too weak to occasion a serious error in the reckoning," but, "after hard and continued gales from the western

[1] *Op cit.*, pp. 160, 161.

quarter the current will be felt with a considerable degree of strength." [1]

In the adventure of *The Speckled Band* Sherlock Holmes has to discover the cause of a girl's sudden death, in the study of currents which we have just described Major Rennell set himself to discover the cause of unexplained shipwrecks. And, as the problems are similar, so too are the methods by means of which they are solved. As we have seen, success was in both cases due to the possession of the necessary knowledge and technique, combined with a keen interest in the problem, and a high degree of constructive power as well as the absence of hindering inhibitions such as a strong prejudice in favour of a particular theory.

Both in interpretation and in reconstruction the interest of the observer may be due to some need of the moment. In that case it presents no new problems. It may, however, be due to some chance occurrence which has attracted attention, either by the novelty or by the intensity of the sense experience to which it gave rise. This is a source of knowledge which we have not considered yet. The history of science and art gives us many instances in which a chance observation leads to a valuable discovery. Pliny tells us how merchants who were cooking their meal on a sandy shore used lumps of nitre from their ships to support their cooking pots,

[1] *Op. cit*, pp. 161, 162.

and how they found to their surprise that the nitre and sand mingled to form a liquid which solidified into what we now call glass.[1]

In more recent times (1746) Musschenbroeck, whilst trying to find a means of storing electricity, happened to hold his apparatus in such a way that the electric current passed momentarily through his body, with the result that he experienced the first electric shock. And to give one further instance, Rontgen in 1895, whilst experimenting with a highly exhausted vacuum tube on the conduction of electricity through gases, was led to the discovery of X-ray photography by noticing that a paper screen covered with barium platino-cyanide which *happened* to be lying near became fluorescent under the action of some radiation emitted from the tube, although the latter was at the time enclosed in a box of black card-board.

In cases such as these the actual production of the phenomenon is, of course, due to pure chance, so far as the worker is concerned, but the interpretation of it, like that of any other stimulus-set, depends on the knowledge which he has at his disposal. Thus Musschenbroeck, writing to Réaumur, says: "I was holding the bottle with one hand, and with the other I was trying to draw sparks from the gun-barrel, when suddenly the hand holding the bottle was struck with so much violence that my frame was shaken as if by a lightning stroke. . . . It is singular

[1] Pliny, *Natural History*, chapter lxv.

that the experiment succeeds only when the vessel is made of Bohemian glass; the shape and thickness are immaterial—the glass vessel must he held by the same person who with the other hand receives the spark."[1]

Musschenbroeck's belief that a certain kind of glass is necessary to produce the shock has since been explained by the mere accident that his Bohemian glass vessel was dry in the upper part, whereas the others were not.[2]

But the discovery of this depended on the knowledge that water is a good conductor of electricity under the conditions of his experiment, and since this fact was not known to Musschenbroeck, it did not strike him that it might be worth while to examine his glass vessels from that point of view. Once again we see that the acquisition of knowledge depends on conscious effort. Chance merely provides the opportunity for making an interesting discovery. Whether that opportunity is turned to account depends partly on the interests of the observer, partly on the "tools" which he has at his disposal.

[1] Quoted in Routledge's *History of Science*, pp. 324–5.

[2] *Op cit*, p 325

SECTION III

THE ACQUISITION OF KNOWLEDGE

INTRODUCTION

In the history of the race the desire for knowledge must have developed simultaneously with the realisation of its value in the practical problems of daily life. And the same is probably true of the early history of every individual, for personal experience soon teaches the child that knowledge enables him to bend his environment to his will—his physical environment by giving him the power to attain his ends in spite of obstacles—his human environment by giving him the means of impressing his fellows with his wisdom or skill. Some retain this attitude towards knowledge throughout life. They form the intensely "practical" members of the community—the individuals who only care for skill and information in so far as it can be shown to help them to master their environment. If the struggle for existence is not too severe, there are, however, always a fair number who begin after a while to take a peculiar joy in the acquisition of knowledge for its own sake. All the same the attitude of these is not that of the child who is trying to put meaning into his environment under pressure from the impulse to investigate; it is rather a fixed desire to know as much as possible about one par-

ticular subject, or to become as skilful as possible in one particular form of expression. In other words, it is due to tension within a conscious complex, and is therefore a derivative of some of the deeper needs of the self.

As a rule this desire appears during adolescence, but it is often only a temporary adaptation which is cast aside when the individual has found his place in his community. For some, it becomes, on the other hand, a permanent form of self-expression: these are the students and the scholars of the world. They, again, may be divided into two classes—those who are primarily interested in the accumulation of material, and those who are primarily interested in the laws which determine its behaviour.

In actual life the person who is *only* interested in useful knowledge is as rare as the person who is *only* interested in "pure" knowledge, and the person who *only* collects as rare as the person who *only* theorises. But we do most of us tend to think some one attitude towards knowledge much more valuable or sensible than any other. In fact, we are often tempted to assume that our opinion and that of those who think like us is the only one which an intelligent person could be expected to hold. Psycho-analysis has taught us that our attitude on this question is in reality a product of our individual psychology. In some the search for knowledge becomes a symbolic outlet for an unconscious complex—these are the students, the explorers, the

scholars. In others some form of mastery over the environment is used for the same end—these are the "pure" practitioners who look upon the others as unprofitable dreamers. But since we all have many desires, and since our development depends on many highly complex conditions, we usually learn to use each of these ways to a greater or lesser extent, and are consequently able to satisfy our needs for self-expression both in the world of deeds and in the world of thought.

In the present section we shall be studying the conscious search for knowledge which ensues from all this. But conscious search is, after all, only an elaboration of natural development. I shall therefore begin by stating the main laws which govern the growth of configurations, and shall then in the later chapters endeavour to show the way in which scientific workers have learnt to help themselves by constructing "thinking-tools" which are more especially suited to their needs.

CHAPTER X

THE GROWTH OF CONFIGURATIONS

IN the course of the earlier chapters we found that the main tendencies which determine the growth of configurations are .

(1) The tendency to see the old in the new.[1]

(2) The tendency for elements within a configuration to remain unconscious, except in so far as certain parts produce awareness when the conscious self encounters an obstacle which it cannot overcome without conscious effort.[2]

(3) The tendency for configurations to function as independent wholes, except in so far as connections have been established between them under the influence of direct experience[3]

(4) The tendency to incorporate within a configuration only those elements of a new experience which happen to be of interest to the self at the moment,[4] and

(5) The tendency to accept information uncritically under the influence of suggestion or in response to a personal desire.[5]

[1] Cf p. 31. [2] Cf. p. 57. [3] Cf. p. 47
[4] Cf. p 30. [5] Cf. p 179.

So far our study of the work of these tendencies has been in the main confined to an examination of the ways in which they aid us to adapt ourselves to our environment, and in the course of this study we have seen of what immense importance they are to our welfare. All the same they are only blind tendencies and are consequently liable to mislead us when circumstances are out of the ordinary, or when we expect them to do work to which they are not adapted. It is this aspect of the problem which will concern us in the present chapter.

Of the five tendencies which I have just enumerated, the second and the third will not detain us long, and it will therefore be convenient to begin with these.

The Tendency for Elements to Remain Unconscious

Owing to the tendency for elements within a configuration to remain unconscious except in so far as an obstacle draws attention to their existence, configurations are liable to contain all kinds of elements, both correct and incorrect, of the very existence of which the individual is not aware. I remember, for instance, the surprise which I experienced as an adolescent when I found that I had stepped on a shiny surface which was sticky, instead of being slippery. Owing to some childish experience the configuration for shininess evidently

ecphored slipperiness as a matter of course. But I was at the time quite unaware of this, and would probably never have discovered it, if I had not found myself actually sticking when the way in which I stepped on the surface was calculated to prevent a slip.

The Tendency for Configurations to Function as Independent Wholes

Owing to the tendency for configurations to function as independent wholes, we are liable to acquire contradictory systems, without realising that they are contradictory. Thus a man may have one code of honour for the office and another for the home, or he may, in perfectly good faith, hold views on religion and politics which, if brought into contact, would immediately strike him as incompatible. As has already been shown, another effect of this tendency is to prevent us from finding connecting links between existing configurations, even when there is no emotional gain to be derived from it. Thus a child at school tends to think of his mathematics and his geography as absolutely different subjects, and it is only when his attention is called to the fact that he realises that he might use his mathematics to aid him in the solution of geographical problems. We shall have occasion to discuss the effects of this tendency again in other connections.

The Tendency to See the Old in the New

We will next consider the tendency to see the old in the new. When we were studying the effects of this tendency in Chapter II we saw that it helps us to adapt ourselves to our environment by enabling us to group our experiences in relation to our needs.

As might be expected from the fact that it is so important to our welfare, this tendency is of great strength. Whatever the new experience, we tend to notice the elements that are familiar rather than those which are new (unless of course the novelty lies in a strong sense-stimulus such as a brilliant colour or a strange noise). This has great survival value under primitive conditions when it is on the whole safer to react quickly than to hesitate unduly, but it is also liable to lead us into unfounded assumptions and rash conclusions. We shall have occasion to work this out in detail when we are considering the difficulties which are encountered in realising the relation of the part to the whole. There are, however, two other effects of this primary tendency, which it will be more convenient to discuss here.

These are (1) the tendency to generalise on insufficient data and (2) the tendency to assume that the apparent is necessarily the real.

(1) If we have twice bought stale cakes at a certain shop, we tend to assume that the cakes at that shop are always stale. If a person has once

deceived us in an important matter, we tend to declare that we know that person to be absolutely unreliable. If a child has discovered that two metals expand when heated, he is as a rule prepared to say that all metals expand when heated. Clearly none of these statements are accurate. What our experience has taught us is that the shop is liable to sell stale cakes, that the person in question may under certain conditions betray a trust, and that of all the metals in existence two were found to expand when heated. All the same, the primitive thinker makes generalisations such as these in perfectly good faith, for the tendency to see the old in the new is so strong that it is by no means easy to control it.

(2) The tendency to assume that the apparent is the real is of course a direct product of the way in which percepts develop, for perception depends on the assumption that recognition marks do not change.

This assumption is as a rule sound enough. It is only when conditions are unusual that it is likely to lead us astray. Kohler tells us how his chimpanzees tried to form a long stick by placing two short ones end to end, how they tried to fix a box against a wall by holding it against it, how they had difficulty in perceiving a box in a corner as a moveable object, because it was visually part of the walls and the floor of the cage. Probably little children experience similar difficulties; at any rate they sometimes try to hold a box against a wall in the

hope that it may stay there and to force a building block into an impossible position by pressing it on the block below it.

Where the lessons of experience are so obvious, a child soon learns to adapt his behaviour to reality. But where the contrary is not forced upon him, he continues to assume that he can " trust his senses." As an instance of this I need only mention the theory that the earth is at rest and that the sun, moon, and stars all move around it. The persistence with which man clung to this idea was no doubt mainly due to the sense of importance which it gave him to think of " his " earth as the centre of the universe. But part of its strength was undoubtedly derived from the fact that it was the common-sense view, the view which was based on the assumption that the apparent is the real.

The Tendency to Ignore the Parts of a Stimulus-set

The tendency to incorporate within a configuration only those elements which are of interest to the self affects the extent to which both the parts and the qualities of an object are realised. Even when the part itself involves no new idea, it is simply not " seen " in the whole, if it has not been isolated before. And its discovery involves an act of problem solving which is by no means easy. Turning again to Köhler, we find that the less

intelligent of his chimpanzees had distinct difficulty in seeing the branch of a tree as a possible stick. One of them, Tschego, failed altogether, "though she clearly showed that she 'had present' the use of sticks all through the experiment, for she doubled straws together into bundles, which would have served her purpose excellently, if only they had not been so short."[1]

In much the same way children of eleven and twelve often fail to see  as two triangles with a common side. For them it is one triangle, with a line down the middle, and the less intelligent do not seem to be really sure that it can be seen as two triangles, until they have actually cut out the big triangle, and obtained the two smaller ones from it. Here again the figure has not been realised as a combination of two figures, because there has previously been no need to consider the parts as wholes within a whole. And in the same way the adult who tries to draw, say, the face of his watch from memory, also often fails in some respect, because he has never noticed, that is to say, has never been interested in, certain of its parts.

The Tendency to Ignore some of the Properties of a Stimulus-set

As in the case of the parts of a whole, so too in the case of its attributes or properties, we only

[1] *Op cit*, p 111

become aware of those which help us to attain our ends. If we are only interested in a person as a worker, we may be unable to tell whether he is dark or fair, tall or short. Or, again, we may know crystals by their colour without any clear awareness of their form.

Of the various attributes of the objective world which the child has to discover, one of the most important is the fact that everything has a name. Stern calls this the greatest discovery of the child's life. Once the baby realises that he need only utter the name of an object or an action to make others understood what he wants, a new world opens before him with the result that he concentrates all his efforts on learning the names of such objects and qualities as he has already isolated in experience. Observation shows that a child usually learns the names of a few objects some time before he realises the true purpose of the name, but at this stage words are learnt at the instigation of an elder. The desire to know the names of things only appears after the child has realised that everything has a name, and that he can increase his power over his environment by learning the names of the objects which interest him.

All this is shown very clearly in the way in which Helen Keller learnt to express herself in words. As is well known, Helen Keller lost sight and hearing at the age of nineteen months, and had, consequently, to be taught entirely through the sense of touch.

Though she gradually learnt to make herself understood by various signs, she had no idea of words until the age of seven, when her gifted teacher, Miss Sullivan, began to instruct her by spelling words into her hand. Miss Sullivan took charge of Helen on March 6, 1887. The following is an extract from the record she kept at the time:

"*March 20th.*—Helen knows eighteen nouns and three verbs.

"*March 31st.*—She has no idea yet that everything has a name.

"*April 5th.*—This morning while she was washing she wanted to know the name for 'water' . . . I spelt 'w.a t.e.r.' and thought no more about it until after breakfast. . . . Then we went out to the pump-house, and I made Helen hold her mug under the spout while I pumped. As the cold water gushed out filling the mug I spelled w.a.t.e.r. in Helen's free hand. The word coming so close upon the sensation of cold water rushing over her hand seemed to startle her. She dropped the mug and stood like one transfixed. A new light came into her face. She spelled water several times. Then she dropped on the ground and asked for its name and pointed to the pump, to the trellis, and suddenly asked me for my name.

"All the way back to the house she was highly excited and learned the name of every object she touched.

"*April 6th.*—Helen got up this morning like a radiant fairy. She has flitted from object to object asking the name of everything, and kissing me for very gladness.

"*May 8th.*—Helen is learning adjectives as easily as she learned nouns. The idea always precedes the word. She had signs for small and large long before I came to her. . . . The other day I substituted the words small and large for these signs, and she at once adopted the words and discarded the signs."[1]

Once a name has been learnt, it becomes an attribute of the class to which it has been attached, with the result that its engram-set becomes part of the configuration which has been formed by that class. Thus the engram-set for the word "table" becomes part of a definite configuration of which having a flat surface which is raised above the ground is another element. The reader who is of a philosophical turn of mind will object that the word "table" is not as essential a part of the configuration as "having a flat surface." But to the primitive mind one is as vital as the other. In fact, even acquaintance with different languages does not always suffice to eradicate the feeling that the name which we give an object in our native tongue is in some way an essential constituent of

[1] Helen Keller, from Miss Sullivan's letters in *The Story of My Life*, pub Doubleday, Page & Co , 1903

the class to which that object belongs. Koffka gives the following anecdote in support of this: "In a conversation on the value of different languages, Mr. Y says finally. 'The English language is the best, and I can prove it to you. Take the word *knife*, the French call it *couteau*, the Germans *Messer*, the Danish *Kniv*, while the English say *knife*, and that is what it really is.'"[1]

Difficulties connected with the Relation of the Part to the Whole

When an attribute or a part has reached the stage of being able to function independently, it becomes a "whole," the functions of which have to be determined before it can be used effectively in problem solving. And inasmuch as our interest in it is due to the fact that it is part of another whole, it is the relation between part and whole which is usually our main concern. This relation gives rise to two questions which are of immediate practical importance. (1) Is every attribute of the whole necessarily an attribute of its parts? And (2) Is a whole connected with its parts in such a way that it is possible to influence the whole by acting on any of its parts? To give definite examples. (1) Does the fact that a mixture is explosive prove that the substances of which it is composed are also explosive individually? Does the fact that the chief

[1] *The Growth of the Mind*, p 324

of a tribe kills such of his subjects as try to rob him prove that his cloak will also kill him who steals it? Or, if he has the power of healing with the touch of his garment, will his blessing cure the sufferer? And (2) Can I heat an object throughout by putting one end of it into the fire? Can I injure my enemy by burning his nail-parings or by sticking pins into a wax effigy of him? Or is it sufficient to mention his name and to wish him evil?

To the primitive unreflective thinker these questions present no difficulty. Owing no doubt to the combined effect of the tendency to see the old in the new and the tendency to perceive only what is of interest to the self, it seems obvious to such a one that the parts of an object have the properties of the whole, and that the whole must be affected by what happens to any of its parts. For the same reason there is at first no distinction between attributes and objective parts, the form, the name, the limbs, and the possessions of an individual being treated equally as "parts" of his self.

In *The Golden Bough* Frazer has collected numerous instances of this. He tells us that the North American Indians "believe that by drawing the figure of a person in the sand, ashes, or clay, or by considering any part of his body, and then pricking it with a sharp stick or doing it any other injury, they inflict the corresponding injury on the person represented."[1]

[1] *Op cit*, Part I, vol 1, p 55

In another place he tells us: "Not only the person of a Maori chief but everything that had come into contact with it was sacred and would kill, so the Maoris thought, any sacrilegious person who dared to meddle with it. Cases have been known of Maoris dying of sheer fright on learning that they had unwittingly eaten the remains of a chief's dinner or handled something that belonged to him. For example, a woman, having partaken of some fine peaches from a basket, was told that they had come from a tabooed place. Immediately the basket dropped from her hands and she cried out in agony that the *atua* or god-head of the chief would kill her. This happened in the afternoon, and next day by twelve o'clock she was dead."[1]

Names are treated as parts of an individual in the same way as his food or his form. Frazer tells us that some Esquimaux take new names when they are old, hoping to get thereby a new lease of life;[2] and that in Abyssinia in the present day it is customary to conceal the real name which a person receives at baptism, and to call him only by a sort of nickname, which his mother gives him on leaving the church, the reason being that a sorcerer cannot act upon a person whose real name he does not know.[3]

Again: "In the village of Buckie, in Scotland,

[1] Frazer, *Psyche's Task*, p. 7

[2] *The Golden Bough*, Part II, p 319.

[3] *Op cit*, p 322.

there are some family names which no fisherman will pronounce. . . . During the herring season those who are unlucky enough to inherit the tabooed name have little chance of being hired in the fishing boats, because they are believed to bring ill-luck with them." [1]

The belief in the efficacy of a blessing and a curse is no doubt partly due to primitive man's immense belief in his own power, but the fact that he is able to assume that the word that he speaks in anger can work harm in much the same way as the spear which he hurls in anger, must be due to his tendency to treat words as concrete objects.

The belief that one can help others by giving them one's blessing, and that one can injure them by cursing them, is of course held by many to this day, but the blessing and the curse are as a rule explained to be of the nature of prayers which tend to be answered, if they are justified by the facts of the case. However, here and there we find even now a primitive belief in the actual power of the spoken word. As lately as 1924 a Devon small-holder admitted that he had attacked a neighbour because she had ill-wished him and bewitched his pig, and demanded that the police should raid her house and confiscate a "crystal" which was in her possession.[2] To-day witchcraft is no longer recognised by the Law of England, but only two hundred

[1] *Op cit*, p 395

[2] *South Wales Echo*, Dec 6, 1924

years ago it was still possible to accuse men and women of ill-wishing others, and in many countries such an accusation would to this day be considered worthy of serious investigation.

Beliefs such as these strike us as ludicrous, but it would be a mistake to interpret this as a sign of superior intelligence on our part. "The flaw—and it is a fatal one—of the system (of primitive philosophy) lies, not in its reasoning, but in its premises, in its conception of the nature of life, not in any irrelevancy of the conclusions it draws from that conception. We stand upon the foundation reared by the generations that have gone before, and can but dimly realise the painful and prolonged efforts which it has cost humanity to struggle up to the point—no very exalted one, after all—which we have reached."[1] To us it seems obvious that it is one thing to destroy the cloak of an individual, and quite another to destroy his nail-parings. But that is the result of our education; we are taught that it is so in the early impressionable years of life, and we accept the teaching under the influence of prestige suggestion.

How little we really need to understand in order to believe is shown clearly enough when we examine some of our own assumptions. We smile indulgently when we read that the Todas think that they can injure an enemy by hiding in the thatch of his house

[1] Frazer, *Taboo*, p 421.

a bundle which contains some hair and five little stones, over which a curse has been spoken in the prescribed manner. We exclaim: How can the bundle be expected to carry the curse to the house! Yet we are not in the least surprised to hear that a person has burnt himself by touching a brick or a poker after it has been taken out of the fire. True, the modern physicist can explain how the burning-power is transferred from the fire to the brick. But we do not wait for such explanations; many of us are probably not even aware that they exist. We simply know that brick and poker can burn us as effectually as the fire, and we know it either because we have been told that it is so, or because we have at some time or other had the misfortune to touch them when they were hot. Are we really so superior to the man who believes that a curse will affect stones and a handful of hair in much the same way as the fire affects the brick and the poker?

It may be said that we can appeal to personal experience. But so can the person who believes in magic. As we saw in the case of the woman who ate the tabooed peaches, it is possible to die of "sheer fright," if you really believe that you have done something that will kill you. In the same way blessings and curses of all kinds often produce the intended effect through auto-suggestion. Moreover, even if a person tries the experiment of ill-wishing another without revealing his action to anyone, sooner or later something will happen which can

be interpreted as a product of the curse. And since the power to bless and to curse is obviously one which adds to its owner's sense of importance, any such event will immediately be utilised to kill doubts which may have arisen under the influence of a failure which was too obvious to be ignored.

Thus progress is necessarily very slow.

How slow it is, and what obstacles are placed in its way by the laws which govern the growth of configurations, is clearly shown in the early history of scientific ideas. I will take as an instance the discovery of the relation of a metal to its oxide.

That a bright metal could be turned into a dull ash by burning it, and that the metal could then be "resuscitated" by heating the ash with certain substances, such as carbon or sulphur, was known to the ancient Greek alchemists; but it was not until the sixteenth century that the discovery was made that the ash was heavier than the metal from which it had been obtained. Then came various explanations for the cause of this increase in weight. In 1630 Jean Rey hazarded the guess that the increase might be produced by air which became lodged in the pores of the metal when it turned into ash, but he did not attempt to support his hypothesis by experiment, and it was passed over unnoticed and forgotten.

The favourite theory of the time was that the increase of weight was due to some part of the fire which travelled through the pores of the vessel

in which the metal was being heated, and that the "resuscitation" of the metal was due to the liberation of these elements.[1]

This theory was clearly due to the tendency to mistake the apparent for the real, or rather to assume ~~that the apparent~~ must be the real. The flame could be seen playing on the vessel, it heated the metal through the vessel. What more natural than to suppose that some part of it actually joined with the metal? As Berthelot points out in *La Révolution Chimique Lavoisier*, what these investigators failed to do was to weigh the air, and there was no reason why they should turn their attention to the air, because nothing was known about its properties. In other words, lack of the necessary configurations caused them to construct what was

[1] The following quotations may be of interest in this connection

(1) "Unde potest hoc absolutæ gravitatis incrementum in metallis meræ flammæ expositis a nobis observatum duci nisi ex partibus quibusdam ponderabilibus flammæ?"—Robert Boyle, quoted by Berthelot in *La Révolution Chimique Lavoisier*, p 32 [Whence can come this increase in absolute weight which has been observed by us in metals exposed to mere flame, if not from certain parts of the flame which have weight?]

(2) "Les pores du plomb sont disposes en sorte que les corpuscles du feu s'y étant insinués ils demeurent liés et agglutinés dans les parties pliantes et embarrassantes du metal, sans en pouvoir sortir, et ils en augmentent le poids Réciproquement, dans la revivification du plomb opéree par fusion, le metal demeure moins pesant qu'il n'était avant qu'on ne l'eût réduit en chaux, à cause de la perte qui s'est faite des parties sulfureuses"—Lémery, *Cours de Chimie*, p 119, quoted by Berthelot, *op cit*, p. 32.

under the circumstances a possible solution of their problem, and this solution was consequently accepted as correct.

We come next to Stahl, who was working at this problem early in the eighteenth century. A mystic and an alchemist, Stahl returned to the theory that a metal lost something when it was reduced to an ash. This something he called phlogiston, and he described it as a combustible principle which could pass from a substance which was rich in it (such as carbon) to one which was poor in it (such as an oxide) when the two were heated together. This theory was found to provide a simple explanation for a number of phenomena which were puzzling investigators at the time, and was, consequently, accepted with great eagerness, though it rendered the observed increase in weight more mysterious than ever. Thus Stahl's theory was a construct which depended on unconscious desires, but which was accepted as feasible by the conscious self, because (1) the tendency to assume that the apparent is the real made it seem at least a possible solution, and (2) the fact that it solved a number of problems satisfied the desire to see the old in the new, that is to say, to group phenomena into manageable classes. It is true that the increase in weight presented considerable difficulty. But the new theory was too useful to be given up without a struggle, and ignorance of chemical phenomena probably made the suggested explanations for the

increase seem less fantastic than we now know them to be. Thus it was generally accepted as correct until Lavoisier finally found a solution which covered all the known facts.

The Effect of Suggestion

The tendency to accept information uncritically under the influence of suggestion is responsible for much of the knowledge which we acquire. In our early childhood our helplessness is so great that we are at every turn impressed by the vast amount our parents know, and by the wonderful things they can do. Hence a strong belief in their power and their wisdom becomes part of the complex which we form round them. Later, when inborn tendencies are urging us to free ourselves from their emotional dominance, this attitude tends to be transferred to parent-substitutes such as the teacher and the leader, whom we consequently expect to be as reliable in their own sphere as we formerly assumed our parents to be in every sphere. Moreover, our gregarious tendencies make it difficult for us to stand alone. And to belong to a group we must of necessity follow the same leader as the other members of that group, which means in the sphere of thought that we just hold the same belief as they do. Thus prestige suggestion and mass suggestion work together to make us ready to accept ideas uncritically, when they come from a source which we have been taught to respect.

There is no need to dilate on the survival value of this tendency. It enables us to learn from the experience of others when personal investigation would be dangerous or impossible, and it places at our disposal a far larger store of knowledge than would be possible to accumulate, without such help. If the reader will look at the history of any scientific theory, such as that of the phlogiston theory of which a sketch has just been given, he will be struck by the extent to which each worker is dependent on the results which have been obtained by his fellow-workers. In our search for knowledge we stand on the shoulders of our ancestors. At best the individual cannot achieve much, but it is thanks to his power of learning from others that the race is able to progress at all, for without it each generation would have to begin again at the beginning.

There is, however, another side to the matter. Under the influence of suggestion we are liable to accept information which is incorrect and theories which are unsound, as information which is correct and theories which are sound, for it is primarily the source from which an idea comes and the impulsions for which it is able to provide an outlet which decide the readiness with which it is accepted.[1] Thus theories which are propounded by someone whose judgment we value, accounts which have

[1] To the primitive mind the objective value of an idea is only of interest if it brings with it clear increase of power, as for instance in the discovery of glazed pottery.

been handed down reverently from generation to generation—especially when absorbed in the impressionable years of childhood—are liable to become part of the permanent stock of knowledge of the individual, and to survive even when new investigations have rendered their value more than doubtful.

A classical example of the force of tradition is given by Galileo's attempt to prove to certain Aristotelians that Aristotle was wrong in assuming that a weight of ten pounds would drop to the ground ten times more quickly than one of one pound. Before their eyes he allowed the two weights to fall to the ground from the top of the tower of Pisa. Yet "with the sound of the simultaneously falling weights still ringing in their ears, they could persist in gravely maintaining that a weight of ten pounds would reach the ground in the tenth part of the time taken by one of a single pound, because they were able to quote chapter and verse in which Aristotle assures them that such is the fact."[1]

It would be a mistake to imagine that this is an exceptional case, or that the lack of adaptability which it shows can be supposed to have been due to nothing more than lack of intelligence. Speaking of the belief in magic and witchcraft Lecky says. "Men were so firmly convinced of the truth of the

[1] *Life of Galileo.* Drinkwater, afterwards Bethune. Ed. 1833, p. 9.

doctrines they were taught, that those doctrines became to them the measure of probability, and no event that seemed to harmonise with them presented the slightest difficulty to the mind. The ablest men were not infrequently the most credulous; because their ability was chiefly employed in discovering analogies between every startling narrative and the principles of their faith, and their success was a measure of their ingenuity."[1]

As an instance Lecky gives among others the case of Joseph Glanvil (1636–80), a divine, who "has been surpassed in genius by few of his successors"[2] In a treatise on *The Vanity of Dogmatising*, Glanvil devoted an entire chapter to the deceptions of the imagination. But he held that a belief in witchcraft was essential for the survival of the Church, because it furnished examples of miracles, which were contemporary and easy to test. Driven by this belief he set himself the task of examining the general question of the credibility of the miraculous.[3] I give part of the argument as quoted by Lecky.[4]

"I must premise that this (*i.e.* Witchcraft), being a matter of fact, is only capable of the evidence of authority and of sense, and by both these the being

[1] *History of the Rise and Influence of the Spirit of Rationalism in Europe*, vol. i, R P.A. Edition, p. 25.

[2] Lecky, *op cit*, p. 40.

[3] Lecky, *op. cit.*, p. 42.

[4] *Op. cit*, p. 42, note 3, and p. 43, note 1.

of witches and diabolical contracts is abundantly confirmed. We have the attestation of thousands of eye and ear witnesses, and those not of the easily deceivable vulgar only, but of wise and grave discerners. Standing public records have been kept of these well-attested relations and epochas made of these unwonted events." And with regard to those who believe that all this proves nothing, he suggests that they "are either more credulous than those whose credulity they reprehend, or else have some extraordinary evidence of the persuasion, viz. that it is absurd or impossible there should be a witch *or apparition*."

Clearly intelligence alone will not save us from accepting incorrect information on trust, or from rejecting possible objections as absurd, if we have a strong desire to believe what we have been told.

The part played by desire in the acceptance and rejection of ideas is so important that it seems worth while to add an example from our own time. As is well known, Lyell the great geologist boldly attacked many a cherished belief of his contemporaries. All the same he found Darwin's theory of evolution peculiarly unacceptable, and was at first disposed to reject it altogether. Writing to a friend (Dr. Joseph Hooker) four years after the publication of the *Origin of Species*, Lyell, who was then sixty-six years of age, says. "I plead guilty to going further in my reasoning towards transmutation than in my sentiments and imagination, and

perhaps for that reason I shall lead more people to Darwin and to you than one who, being born later like Lubbock, has comparatively little to abandon of old and long-cherished ideas, which constituted the charm to me of the theoretical part of the science of my earlier days, when I believed with Pascal in the theory, as Hallam terms it, of 'the archangel ruined.'"[1] Thus, even a highly gifted worker, who is himself an expert in scientific method, may find it extremely difficult to accept a theory which threatens his established outlook on life, even though he fully recognises the soundness of the investigations on which that theory is based.

[1] *Life of Charles Lyell*, vol. ii, pp. 361–2.

CHAPTER XI

THE NATURAL GROWTH OF CONCEPTS

Definition of Concept

We have already seen that man is so constituted, that he is able to become aware of the configurations which belong to the systems of his conscious self, and that he has learnt to help himself in his efforts to isolate the more important of them by endowing them with special names. When configurations have reached this stage it is usual to call them *concepts*.

The term "concept" has been defined in several ways. Professor Spearman, in discussing some of these, suggests as a satisfactory definition "an item of awareness considered in respect of its essential character, and without reference to any particular occurrence."[1] In this definition the term "character" is to be taken to include all attributes which do not involve a relation,[2] that is to say, all properties which enable us to realise the existence of the concept as an independent entity. Thus a table has, among others, the property of being a

[1] *The Nature of Intelligence and the Principles of Cognition*, p. 263.

[2] *Op. cit.*, p. 66 note.

flat surface, which is supported in such a way that it can rest in a horizontal position at some distance from the ground. This is common to all tables. It does not involve a comparison of the table with another object, nor does it refer to any particular table at any particular time or place. Hence it forms part of our concept of a table.

All this may seem very artificial. We certainly do not look to see whether an object has a horizontal flat surface before we venture to call it a table. If asked we should simply assert that we "know" it is one. But that is merely because the recognition marks ecphore without producing conscious awareness. In cases of doubt, say in an attempt to name an unfamiliar plant, we do definitely look for the recognition marks or properties which will enable us to discover what it is.[1]

The Naming of Concepts

As is clear from the definition a concept has no existence outside the mind which conceives it. In the concrete world we only find individual objects—stones, plants, animals. Presently contact with them makes us aware of some of their properties; we discover that a particular stone is hard and cold, that a particular plant is poisonous, that a particular animal is timorous, but we do not experience a stone-class, a plant-class, or an animal-class,

[1] Cf. *Psychological and Logical Concepts* in Ch. XII.

except as illustrated by particular specimens, neither do we experience hardness, coldness, poison, or fear, except as properties of definite concrete objects or creatures.

Since a concept is essentially an item of conscious awareness, there must be some means of presenting it to oneself and others. But since it is unlike anything which exists in reality, imagery and drawing are clearly of no use for this purpose. Neither is it of any use to attempt to enumerate its essential properties—even in the case of the comparatively few instances in which they are known—because properties are themselves concepts, and consequently not suited to representation in the concrete. The concept is in fact an abstraction, a thing which is in its very nature unrepresentable.

Yet we can think consciously in terms of concepts, but we probably owe this largely to our ability to express ourselves in words. From the point of view of mental evolution, language is undoubtedly one of the greatest discoveries that the human race has ever made, for language consists of a number of artificial combinations, which cannot from their form suggest some one particular experience, and which consequently almost force the individual to become aware of his configurations. It is true that a word may at times suggest a particular meaning, but that meaning is not misleading, because it is an essential character of the concept, and is thus a help rather than a hindrance in the

evolution of the concept. As instances of this I need only remind the reader of onomatopœic and imitative words, such as " buzz " and " zig-zag," and of the modern artificial words such as " telephone " and " aeroplane."

Language as we know it consists entirely of words, but any other system of artificial signs would obviously have done just as well. All that is essential is that the signs should not mislead the thinker by suggesting particular cases, and primitive races do, as a matter of fact, supplement their somewhat limited vocabulary by making use of a system of more or less artificial signs.[1]

The reason why the word has gradually supplanted the artificial sign is, that it can be used in the dark and across small intervening obstacles, whereas the sign can only be seen, if there is sufficient light, and if the " speakers " happen to have a clear space between them.

The original discovery of concepts must have been a slow and difficult process, but to learn them from others with the aid of words is a comparatively simple matter, for the use of the same name in connection with different objects groups those objects for the learner, and its use for the same

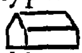
[1] The imitative gesture is of course the reproduction of a particular experience, and as such not helpful to the growth of concepts. For a fuller discussion see Tylor, *Primitive Culture*, vol. i, ch. v.

quality in different settings draws attention to the quality as such. Hence a child rapidly acquires a working knowledge of the concepts which he finds in use in his environment.

At the same time it is important to bear in mind that a concept is a configuration which is able to produce conscious awareness, and that the actual meaning which a word conveys to the learner depends on the configuration which it is able to ecphore. Thus a "cat" may be merely "that which scratches" and "good behaviour" may be equivalent to "sitting still." If a word is given without the necessary basis of concrete experience, even stranger things may happen. "An idol made with hands" has before now been interpreted as "An idle maid with hands," and the equator has been known to be defined as "a menagerie lion running round the earth." It should be realised that such incidents are not due to lack of goodwill on the part of the children. They are, on the contrary, often the product of a serious effort on the part of the learner to put meaning into what he hears. Finally, even a definition which does not contain anything so abstract as "an imaginary line" may yet be worthless if the necessary configuration is not formed by means of actual personal experience. Thus the definition of a locus as "the path of a point which moves so as to satisfy certain given conditions" means very little, even at the age of fourteen, until a number of such paths have

actually been drawn. And in practice it is always found better to teach as nature teaches, that is to say, to ensure the formation of the necessary configuration by letting the pupil construct a number of different paths, and to use the knowledge he has acquired in this way to help him to formulate the essential properties of the locus-concept.

The Function of Imagery

Whilst some system of artificial signs would appear to be essential for the discovery of concepts, it is apparently not necessary for their correct use once they have become familiar. On the contrary, many thinkers seem to feel that it is the image rather than the word which is vital to the process. Investigations such as those of Betts[1] have shown that the images which are actually used may represent one particular member of a class of a series of members, or some kind of schematic representation of some of the essentials. Thus the concept "house" may appear with the word "house," with an image of some particular house, with a series of images representing different types of houses, with an outline drawing such as  or finally with the word "house" accompanied by one or other of these forms of imagery. But though all these methods would seem to be equally effectual when the material is familiar, the word or, when the work

[1] Cf. Betts, *The Distribution and Function of Mental Imagery*.

requires it, the schematic image are undoubtedly safer when it is unfamiliar. The beginner who draws an equilateral triangle when he has to prove that a relation holds for any triangle is liable to find himself making assumptions, which are only valid for the particular figure which he has drawn for his guidance. In the same way the learner who relies on one or two images, when he has to formulate characters of labiates, will probably include accidentals and omit essentials.

For the person whose imagery is good, it seems hardly worth while to discuss whether the image is a vital part of the thought-process. He is always aware of images when he is thinking, and would probably declare that there can be no conscious thought when there is neither image nor word present in the mind. All the same, it would appear from the work of experimental psychologists that it is at times possible to experience what is known as imageless thought. Professor Aveling, for instance, concludes from the introspections he obtained from highly trained observers that "the main associations manifest in thought-processes obtain between pure concepts and the conceptual elements of images."[1]

He gives among others the following examples from the protocols (*i.e.* records of introspections):

"I had a distinct memory idea of a hammer with no image and no word."

"The knowledge that Ferod (the nonsense word)

[1] *The Consciousness of the Universal*, p. 154.

meant 'running away' came first of all. 'Running away' was not present, except as the meaning of Ferod."

"Then quite suddenly came the meaning 'bird.' I could detect no image of any kind."

"Nothing, except that I knew what it meant."[1]

Probably instances such as these would only be noticed during introspection or when there is for some reason exceptional difficulty in becoming conscious of a thought which is as it were rising to the surface. Ordinarily we tend to become aware of images or words when we are engaged in thinking of any kind. In dealing with abstract ideas many of us think purely in words, but in the solution of concrete problems and in the recall of concrete events, those who have imagery tend to use it, and those who use it freely tend to think that it is an essential feature of the process. However, once again, experimental psychology is teaching us that we are mistaking the apparent for the real.

Even in a concrete case where an image might be thought to be definitely helpful, the solution can apparently be found without making any use of it. As an instance we may take an experiment which Betts gives in his investigation into *The Distribution and Function of Mental Imagery.* Betts sets his subjects the following task:

"A three-inch cube, painted red, is sawed into inch cubes.

[1] Aveling, *The Consciousness of the Universal*, pp. 157–8.

(*a*) How many of the inch-cubes have paint on three faces ?

(*b*) How many on two faces ?

(*c*) How many have no paint on them ?

Now describe the images, if any, which came before your mind in thinking out the answers."

In discussing the result Betts says : "The fact that 35 per cent. of the cases made the solution without the use of imagery, and made as good a record in accuracy and speed as was made by those who reported the presence of imagery, makes one seriously question whether the accompanying imagery may not have been an incident rather than a necessary factor in the solution in many of the other cases as well."[1]

For a critical discussion of the evidence which is available on this point the reader is referred to chapter xii of Professor Spearman's *Nature of Intelligence and Principles of Cognition.* He concludes that "the decision on this question lies still hidden in the womb of future research." All the same, he considers that the experimental work which is at our disposal points to the fact that thinking is no more based on images than "the heat of a fire is derived from its smoke, or an electric train is impelled forward by its wake of sparks"—in short, that "the sensory concomitants of thought are degraded into little more than accidental waste

[1] Betts, *The Distribution and Function of Mental Imagery*, 1909, p. 72.

products."[1] This is in accordance with what we have been led to expect from our analysis of construction and recall, for imagery must inevitably be of the nature of a by-product, if the vital part of these processes consists in the unconscious ecphory of configurations. Thus, the experimental investigations into the function of imagery would seem to confirm the results obtained with the aid of the psychology of the unconscious.

Classification of Concepts

We turn next to the consideration of different kinds of concepts.

It is clear from our definition that a concept is that part of a configuration which has acquired the power of functioning in such a way, that the conscious self is able to become aware of it as an entity. The inborn tendencies which are responsible for the growth of configurations are, as we know, concerned with (1) the grouping of objects in accordance with our needs and (2) the recording of such properties of objects as are of interest to the self. Corresponding with these two functions we have two different types of concepts—the *object concept*, which enables us to think of a class of objects without reference to a particular specimen, and the *property concept*, which enables us to think of qualities and possibilities as though they had individual existence apart from the objects in which they occur.

[1] *Op cit*, pp 192–3.

Object Concepts

Object concepts are from their very nature always class concepts. When we are thinking of a table or a cat without reference to any particular table or cat we are thinking of a type which we expect to have certain properties—namely, the properties of the class which it represents. It is true that we are not consciously aware of those properties at the time, but we are as a rule inclined to think that we could make them conscious if necessary, and are often surprised to find how little the conscious self really knows about the recognition-marks of objects which it would recognise without fail. If the reader doubts this he should try to define a familiar concept such as "animal" in such a way that his statement includes all that is true of every animal, and excludes all that is only true of some of them.

Since we only classify experience in response to a felt need, our early object concepts are all derived from direct experience with individual objects. But presently these primary concepts themselves become objects of thought, and our more complicated needs demand that they too shall be grouped into serviceable classes. We think of table and chair as "furniture," of pots and pans as "cookery utensils," and in response to further needs we presently classify furniture and cookery utensils as "household goods." Thus object concepts tend

to increase in generality as our interests become wider and more complicated.

Anyone who has had much occasion to watch lessons must have been struck by the fact that children are as a rule unwilling to adopt the conventional names for some of these more general concepts. I have, for instance, seen more than one class of eleven to twelve, after a careful explanation of the meaning of "cookery utensils," cheerfully use the expression "pots and pans" in the exercise that was set at the end of the lesson. No doubt children could be made to use such a term by awakening the necessary desire, for they use others, such as "toys," at a much earlier age. It seems possible, however, that this would hinder rather than help their mental development. Meumann tells us that just the more intelligent children tend to think in terms of individual concrete events up to the age of twelve or thirteen, and that it is on the whole the less intelligent who are more ready to use abstract terms. He suggests that the tendency to think in the concrete should be encouraged in children, because it enables them to provide themselves with a large store of concrete material from which they can at a later stage abstract concepts which they need. As he points out, the concept which is derived from a large store of material is of necessity richer in meaning and consequently more serviceable in practice than the concept which is based on material which is only just enough to make

it possible for the learner to use the corresponding word correctly.[1]

Property Concepts

We saw in the last chapter how the needs of an individual gradually force upon him awareness of the objects which he has to handle. He discovers that some things are hard, that some creatures are liable to bite, and that some persons are liable to lose their temper. Observation shows that he may learn to modify his behaviour under the influence of discoveries of this kind long before the configurations have achieved enough independence to function as concepts. Avebury tells us that some of the most backward races have to this day no special names for the qualities of objects. Yet they are in a sense aware of their existence, for they express them when necessary with the aid of a simile; thus, hard is "like a stone," round "like a ball" or "like a moon."[2]

Probably children go through this stage as part of their normal development. Thus, for instance, Helen Keller, the blind and deaf girl, had signs for small and large long before Miss Sullivan began to teach her. "If she wanted a small object and was given a large one, she would shake her head and

[1] Meumann, *Vorlesungen, zur Einführung in die Experimentelle Pädagogik*, 1911, vol 1, pp 499–500

[2] Avebury, *Prehistoric Times*, p 566

take up a tiny bit of the skin of one hand between the thumb and the finger of the other. If she wanted to indicate something large, she spread the fingers of both hands as wide as she could and brought them together as if to clasp a big ball."[1] Clearly the signs Helen used until the age of seven fulfilled exactly the same function as the similes which primitive man uses to express his meaning.

A backward boy of four whom I had once occasion to observe whilst he was playing with bricks seemed to be at about the same stage of development. This child at first gave the impression of not knowing the difference between large and small, for he would give any brick at random, whether he was asked for "a nice large brick" or for "a tiny little one." Yet he really had quite a serviceable appreciation of variations in size, for he did not once attempt to put a brick into a hole that was too small for it, when he was putting his bricks back into their box, at the end of the morning. In cases like these we seem to be dealing with configurations which have acquired sufficient independence to be able to influence behaviour, but which have not yet become part of the system of the conscious self, and are, therefore, not yet able to function as concepts.

Of the various property concepts the quality concept and the quantity concept suggest certain points of special interest.

[1] Helen Keller, *The Story of My Life*, Edition Doubleday, Page & Co, p 319.

(a) *The Quality Concept*

When a quality concept has been formed, the next stage would appear to be the isolation of various grades within it. At first a quality seems only to be realised as present or not-present. Thus Professor Spearman tells us of a little boy of two, who for a time divided all the objects he touched into "burn" and "not-burn."[1] Further, the ancient Egyptian language would appear to contain a number of words which represent qualities without any reference to their degree. Thus ancient Egypt has only the one word *ken* to express the whole of the concept "strong-weak," and to avoid ambiguity the word was followed by the picture of an upright armed man, if it stood for strong, or by that of a lazy cowering man, if it stood for weak. A little later the two extremes have evidently acquired the power to function as independent concepts, for we then find *ken* is kept for "strong" whilst a new word *kan* is used for "weak."[2]

This is the stage which most of our quality concepts have reached to-day. It shows that as a rule only the extremes have acquired enough independence to be able to function as concepts. In fact, temperature would appear to be the only exception;

[1] *Op. cit.*, p 265

[2] Quoted by Freud in *Uber den Gegensinn der Urworte.*

there we have the range hot-warm-cool-cold to define our sense-experiences. In every other case further grading can only be obtained by resorting to quantity concepts, which is really a return to the simile of the backward races. When we say that the temperature of a room is 60° F. we mean that it is the same as the temperature which would cause the mercury in a Fahrenheit thermometer to rise to point marked 60°. When we say that a car has an 8 h.p. engine we mean that it has an engine which can do as much work as eight horses. Needless to say, these more elaborate systems of grading have arisen out of the study of science and technology, and though the meaning of terms such as horse-power, candle-power, and degree of heat has become part of our conventional stock of knowledge, the actual grades continue to mean little to most of us, for we have, as a rule, little opportunity to associate them with definite sense-experiences. Hence we find that we can in practice convey our meaning much more effectually by using the two extremes of the range modified when necessary by some equivalent of "much" or "little." To say that a room is unpleasantly cold conveys far more to most people than to say that its temperature is barely 40° F.

(b) *The Quantity Concept*

In the case of quantity concepts the position is quite different. Numbers under twenty probably

convey a definite meaning to every normal person who has grown up in a community such as ours, and many of us feel that numbers up to a hundred, or even up to a thousand, still suggest clear sense-experiences.

Anthropologists tell us that number concepts develop very early in the history of mankind, probably because the more enterprising races all discovered before long that they could use their resources to better advantage by establishing a system of barter between themselves and their neighbours. In West Africa, for instance, "a lively and continual habit of bargaining has developed a great power of arithmetic, and little children already do feats of computation with their heaps of cowries," and "among the Yorubas of Abeokuta to say 'you don't know nine times nine' is actually an insulting way of saying 'you are a dunce.'"[1] (Tylor compares to our disadvantage the English "as sure as I'm alive and knows how many beans make five.")

Like every other concept that of number owes its existence to a felt need. Hence it is not surprising to find that some of the most backward races have only isolated as few as five or six. Tylor mentions Australian tribes, whose number names are limited in one case to one, two, two-one, two-two and in the other to one, two, three, two-two, two-

[1] Tylor, *Primitive Culture*, vol. i, p. 242.

three, three-three.[1] When these tribes have to do with higher numbers they use their knuckles and their fingers to help them. Tylor says: "I once wished to ascertain the exact number of natives who had been slain on a certain occasion. The individual of whom I made the enquiry began to think over the names—assigning one of his fingers to each, and it was not until many failures and consequent fresh starts that he was able to express so high a number, which he at length did by holding up his hand three times, thus giving me to understand that fifteen was the answer to this most difficult arithmetical question."[2]

This method of calculating the required numbers suggests the same stage of development as the use of similes for qualities. The individual has configurations, which enable him to represent ten or fifteen if required, but these configurations have not yet reached the stage of being *items of awareness considered without reference to a particular occurrence*, that is to say, they are not yet able to function as concepts.

The adult who has grown up in a community such as ours is accustomed to handle numbers without reference to any particular group of objects,

[1] I.e., in the first case 1 ganar, 2. burla, 3 burla-ganar, 4. burla-burla and korumba more than four, much, great, and in the second 1. mal, 2. burla, 3. guliba, 4 burlarr-burlar, etc.—Tylor, *Primitive Culture*, vol. 1, p 243.

[2] *Op. cit.*, p. 244.

and he usually does not remember the difficulties he had as a child. But as a matter of fact the child of to-day finds them no easier to understand than primitive man did in the past. There is, for instance, a stage when a child recognises a whole of a certain size without realising that it owes its size to the units of which it consists. Thus Koffka [1] quotes the case of a child of four years and nine months, who had learned to comprehend a group of four members, but who failed to recognise two pairs of cherries as four single cherries, and the cases of two children aged respectively two years seven months and two years ten months, who could make use of "two apples," but not of "two eyes," "two ears," etc. He also points out that children are often greatly astonished to find that the five-spot domino corresponds to the quantity five. Similarly Miss Murray tells me that a child "sees" a six-spot domino as two threes long before he can realise it as the sum of two spots and four spots, and that an intelligent boy of just under six years of age thought it "very funny" when he discovered that two threes was the same as three twos. All this suggests that children at first recognise groups by their form, without becoming aware of them as symbols of quantity.

It is of course possible for a child to pick out *e.g.* the five-spot domino correctly, without knowing the meaning of the term five-spot; all that is needed

[1] *Op. cit.*, p. 333.

is that he has discovered some means of recognising the domino, and has learnt to attach the conventional label to it.

Presently, in the course of his efforts to understand what his elders are talking about, the child begins to realise the group as an aggregate of similar individuals which can be used to determine its size. But even when he has realised this fact in relation to one particular group, it does not follow that he can apply his discovery to all similar groups. Stern, for instance, gives us the case of a child of four years three and a half months who, when asked by his grandfather "How many fingers have I?" replied, "I do not know, I can only count my own fingers."[1]

Finally, ability to count does not necessarily imply any realisation of the fact that the size of a group can be obtained by counting its members. Thus, Stern tells us that his daughter Hilda at the age of three years seven months, though able to count the fingers on the hands of others, yet had no idea that the counting gave her the number of fingers. She reacted to "how many fingers are there?" by counting them, and when asked a second time simply counted the fingers again. The last finger was indeed the fifth, but the total number of fingers did not yet mean to her the sum of five.[2]

With us a child has usually overcome these difficulties by the age of six or seven, but this is

[1] Koffka, *op. cit.*, p 334.

[2] Quoted by Koffka, *op. cit.*, p. 335.

due to the help we give him by using the same words for counting and for naming sums. To the primitive mind there is at first no necessary relation between these two processes. The fact that a certain individual is fifth and last in rank does not appear to imply that he must be one of a group of five. Hence primitive people to this day often use one set of words to express the size of a group, and another set of partly different words to count the individual members of which it consists. And, not content with this, some appear to have yet another set of special words, which they only use for counting money.[1]

Class Concepts

We have seen that the object concept depends on the awareness that a number of individual objects can be grouped together for a particular purpose. An object concept is, therefore, always a class concept. A property concept on the other hand owes its existence to the awareness of a unique experience which has occurred in setting after setting, until it has finally achieved enough independence to be endowed with a special name. Thus the peculiar sense-experience which is produced by touching hot objects of any kind presently leads to the realisation of "heat" as a true concept, that is to say, as an item which can exist in con-

[1] Wertheimer in *Zeitschrift für Psychologie*, 1912.

sciousness without rousing awareness of any definite object which happens to have the quality of being hot. Similarly repeated awareness of feeling frightened presently leads to a concept of fear, repeated awareness of wanting to fight to one of pugnaciousness, and repeated awareness of wanting more or less of an object to one of quantity.

Under the influence of our environment we gradually acquire concepts of all the more common properties of the objects with which we have to deal, and, as our stock increases, our tendency to organise our experiences asserts itself once more, with the result that we presently find ourselves grouping properties in accordance with some interest or need red and yellow are realised as colour, fear and anger as emotion. In this way we begin to become aware of class concepts in which properties function as "objects." We learn to think of "colour" without becoming aware of any particular colour, just as we previously learned to think of "table" without becoming aware of any particular table.

To sum up, a configuration functions as a concept when ecphory within it produces conscious awareness of its existence. Hence every concept is a configuration within the system of the conscious self. Concepts may be used in the identification of objects or of their properties. I have called the former object concepts, the latter property concepts. Object concepts are produced by our efforts

to group experiences together in accordance with our needs. They are, therefore, always class concepts. Property concepts are, on the other hand, due to the realisation of the existence of a property as apart from the objects in which it occurs. Hence the primary property concepts stand for unique experiences. Finally object concepts and property concepts may themselves become "objects of thought" which have to be grouped together in response to some need, and it is thus possible to have class concepts of classes and properties. As our interests widen the new classes to which they give rise become more and more general, until we should theoretically reach an object class which covers all existence, and a property class which covers all experience.

CHAPTER XII

THE EFFECT OF CONSCIOUS CONTROL

(a) THE LOGICAL CONCEPT

The Psychological Concept

When a concept is the product of natural growth, it is usual to call it a *psychological concept.* As we saw in the last chapter, such a concept is often both incomplete and incorrect, but it is only at a high stage of evolution that man becomes aware of this danger. At its first appearance the power to look before and after has just the opposite effect. For man discovers that he can foresee what is going to happen; that he can alter the course of events to suit his needs. In his own estimation he becomes master where previously he was slave. In reality his power is of course still very limited, but that does not discourage him. Probably he is not even aware of it, for his tendency to perceive only what is of interest to himself and to block all contrary configurations tends to make him dwell on his successes, and to ignore his failures or at least to explain them away to his own satisfaction. The result is a tremendous belief in the power of the self. At this stage—we can see it in every little child—

there is nothing the individual cannot do. And since the constructive process is entirely unconscious his ideas seem to be the direct result of his desires (cf. Construction, p. 166). Hence he believes that he can get what he wants by concentrating on the desire to get it. As Freud puts it, this is the stage at which the wish is the deed in the sense that it is believed to produce the end without further effort on the part of the wisher. Later, when sad experience has taught the individual that his efforts do not always have the desired effect, what usually happens is that he comes to the conclusion that it is only his own self which is not strong enough, but that the chief, the magician, or some other father-substitute undoubtedly has that unlimited degree of power which he would like to have himself. So long as this belief has a strong hold on the mind of man, life is full of unknown dangers; for the leaders at any rate can obtain all they desire by merely wishing it, and the wise man consequently avoids the unknown as far as possible.

Frazer and others have shown how, from a belief in the unaided power of the human will, man gradually rises to a belief in spirits who govern the world, and who can be persuaded to attain his ends for him, if only he knows how to approach them. Then comes the search for reasons and with it the birth of science. It is true that man still expects to find some being responsible for his misfortunes, but he is at any rate driven to seek a non-human cause,

and with that he is on the path which ultimately leads to the discovery of the laws of Nature.

So long as man has no desires beyond those which are engendered by the immediate present, his psychological concepts serve him well enough; so long as he believes exclusively in the power of the wish, they can, moreover, give him all he can use. But once he has begun the search for non-human agencies, these same tendencies are liable to hinder him at every turn, for what he needs then for the first time is some idea of the world as it *really* is, whereas all his configurations can give him is the world as he has interpreted it under the influence of his personal wants. To use Freud's convenient terminology, what he needs, if he is to discover the cause of effects, is some knowledge of "objective reality," whereas all he knows anything about is his own particular "psychological reality."

According to Milhaud (*Les Philosophes Géomètres de la Grèce*) the Ionians of the time of Thales (640–546 B.C.) were the first to make a systematic attempt to explain phenomena in terms of general principles. Of the works of Thales only two statements have been handed down to us. These are—(1) Water is the cause of everything and (2) the world is full of Gods. It is noteworthy that both point to the existence of extra-human agencies. Moreover, he based his belief in the importance of water on observation, not on intuition,[1] that is to say, he made

[1] Aristotle, *Met.* i. 3, quoted by Milhaud, *op. cit.*, p. 65.

definite efforts to discover objective reality instead of contenting himself with psychological reality.

Since the time of Thales, if not earlier, there have always been men who realised that nature has laws of her own, which can only be discovered by careful observation of what actually happens. But it is only lately that the rapid progress of science has convinced the mass of men that there is something to be said for their methods. Even now there is a strong tendency to believe that the genius can find objective truth in his own inner consciousness, and that it is only the mediocre worker who has to "grub for it in the earth."

The reason for the unpopularity of those who believe that they cannot solve objective problems without first collecting the necessary data is undoubtedly that their attitude constitutes an attack on man's belief in his own importance. Just as the little child thinks that everyone is there for his benefit, so men like to think that their God made the world solely for their use, and that he will give them in the form of inspiration or intuition whatever knowledge he thinks good for them.

A belief which is so flattering to the egotism of man is not likely to be given up in a hurry. Moreover, it has to be remembered that ideas do appear in the mind in ways which seem absolutely unaccountable without some knowledge of the mechanism of the unconscious, and that our knowledge of these mechanisms is very recent (cf. Construction, p. 168).

Hence it is not strange to find that man long believed that he could find all knowledge within himself, if only he had the necessary ability.

To-day this attitude of mind is probably only found among workers who have had little or no training in scientific method. A student of physical science, for instance, would certainly not attempt to foretell phenomena, unless he thought he knew the causes which govern them. But early in the seventeenth century so great a man as Kepler could still hold in good faith that he could find within his own mind the number of moons which each planet should have. Hearing that Galileo had discovered that Jupiter has four moons, he wrote to him: "Such a fit of wonder seized me at the report, *which seemed so very absurd*, and I was thrown into such agitation at seeing an old dispute decided between us *in this way*, that between his [the messenger's] joy, my colouring, and the laughter of both, confounded as we were by such a novelty, we were hardly capable, he of speaking or I of listening. I am so far from disbelieving the existence of the four circumjovial planets that I long for a telescope to anticipate you, if possible, in discovering two round Mars (*as the proportion seems to me to require*), six or eight round Saturn, and perhaps one each round Mercury and Venus."[1] (The italics are mine.)

To say that a discovery is "absurd" and to go

[1] Drinkwater, afterwards Bethune, *Life of Galileo*, ed. 1833, pp. 26–7.

on to predict the number of moons round other planets without knowing anything about the laws which govern their formation would to-day be considered highly unscientific. It belongs to a stage of development in which the world is still held to be governed by a mind similar to our own, a mind too whose processes will be revealed to us in the form of intuition or inspiration if only our wish to know is strong enough.

The Logical Concept

As objective reality begins to be studied for its own sake, concepts change correspondingly. Instead of being the result of chance experience they are now the outcome of investigations which have been undertaken in order to discover the essential characters of the class in question. Concepts of this nature are usually called *logical* concepts. *Hence the concept of a class is said to be logical when all the essential characters of that class have been determined.*

On account of the greater definiteness of the information which it puts at the disposal of the thinker, the logical concept tends to alter his attitude towards his environment. Thus the person who has a logical concept of "birds" realises that he is dealing with a class which has been formed by human beings in their attempt to understand their environment. He knows the essential properties of

birds, and in the light of that knowledge is able to establish beyond doubt whether a particular specimen is or is not a bird. And he is, moreover, able to deal with a creature like the duckbill by pointing out that logical concepts are mental constructs, which help us to discover objective reality, and that the fact that we have formulated the essential character of birds and mammals only means that the animal kingdom actually contains these two distinctive classes. It does not mean that they have always been distinct, nor does it mean that it is impossible that another class—a transition stage between the bird and the mammal—might not exist as well. On the other hand the person who has no logical concepts may not even realise that he is thinking in terms of classes. He knows a bird when he sees one, because it ecphores the configuration which he has learnt to label "bird," but until it is pointed out to him he may never have thought of birds as a class, nor realised that that class is a mental construct, which he has acquired under the influence of experience. If asked, he can give some of the properties of birds, he knows that they have beaks and feathers, that they build nests, and so forth, but, if pressed, he is unable to say which of these properties are characteristic of all birds and which only of some of them. Finally, if faced with a duckbill he would either classify it at random or rest satisfied with the assertion that it is certainly not an ordinary bird To sum up, the thinker who

uses logical concepts is throughout aware of what he is assuming, and is therefore far less at the mercy of his inborn tendencies than the thinker who uses psychological concepts and is consequently only aware of some of the elements which determine his classification. In the search for objective reality conscious control is essential for success, and it is for this reason that the thinker who is trying to master his environment prefers to rely on logical concepts.

Property Concepts

In the case of concepts of objects we are always dealing with classes Hence any of these can be made "logical" by determining the essential characters of the corresponding group. But in the case of properties or characters the concept may, as we have seen, concern either a unique experience or a group of such experiences. We can have concepts of blue-ness or anger, as well as concepts of colour or emotion. The former are unique experiences, which have been abstracted from the wholes in which they occur, the latter are classes of such experiences. From our definition of logical concepts it follows that only the latter can be made logical, the former being by their very nature always psychological. Of the class concepts of properties which man has evolved for his own use, the most interesting are those of form and number.

(a) *Psychological Concepts of Form and Number*

We saw in Chapter VI that children recognise form at a very early age, and that this recognition is at first independent of size and position. In fact classification of similar figures as members of the same class would seem to arise immediately out of the mechanism which controls the growth of configurations. If a baby can mistake a doll's bottle for his own, it is not strange to find that the older child experiences no difficulty in classing all three-cornered figures as triangles.[1]

Number concepts cause far more difficulty. We have seen some of the obstacles which the child has to overcome before he can even isolate them as individual property concepts.[2]

Once this stage has been reached the tendency to see the old in the new helps him to form psychological class concepts. He finds that all numbers can be added, subtracted, multiplied, and divided. He is taught how to cancel fractions, or how to add them, and he assumes as a matter of course that the method which will do for one pair of fractions will do equally well for any other pair. That is to say, he has formed true psychological class concepts of number.

(b) *Logical Concepts of Form and Number*

Both with form and with number, logical concepts are not appreciated till much later. For the

[1] Cf p. 109, also Koffka, *op. cit.*, p. 289. [2] Cf. p. 249.

child of average ability they probably mean little until he has reached the age of thirteen or even fourteen. This is particularly the case with number concepts. To construct algebraic formulæ and to handle them intelligently is a very difficult task for the beginner, and most of us would certainly never achieve it without special instruction. Form concepts appear easier to grasp because it is usually possible to find adequate concrete equivalents for them. We can draw something which is sufficiently representative of *any* triangle to enable us to use it as a substitute, and we can then prove our *general* theorem from the *particular* case in front of us. But if we were to investigate what the average schoolboy means by the term "any triangle" we should probably find that he means a triangle which has no two sides of the same length.

In the history of the human race psychological class concepts of form and number developed at an early stage of mental evolution. Logical concepts on the other hand seem to be a fairly recent acquisition. The thinkers of Ancient Egypt, for instance, never rose above the use of empirical rules in its calculations In a civilisation as advanced as theirs it was obviously important to be able to determine areas and volumes. Moreover, it was necessary for them to be able to ascertain the North–South line when they were building their temples. Under the pressure of such needs as these they gradually invented empirical rules, which served their purpose

well enough. As is well known, they discovered that a triangle which has its sides in the ratio of 3 : 4 . 5 always has a right angle opposite its longest side, they also had methods for determining the areas of squares, quadrilaterals, and circles, and the volume of certain solids. But even as late as the seventh century B.C., no attempt seems to have been made to prove the truth of the rules that were being used, for right and wrong persisted side by side without further investigation.[1]

According to Proclus, it was Pythagoras and his disciples who first developed logical concepts of form and number[2] Not content with empirical rules, they turned their attention to the general case and were thus able to investigate the essential characters of the class for which it stands. As an instance we may once more take the right-angled triangle. The Egyptians were satisfied when they had found how to construct such a triangle. For the Pythagoreans this was on the contrary merely the starting-point. What they wanted to know was why this particular type of triangle should always have a right angle. Hence they investigated the properties of right-angled triangles as such, discovered that the square on the hypotenuse is always equal to the sum of the squares on the other

[1] The area of a quadrilateral was, for instance, stated to be given by the product of adjacent sides, no matter what the angle between those sides

[2] Milhaud, *op cit*, p 79

two sides, no matter what was the length of those sides, and finally proved that this in turn is the inevitable result of other geometrical truths. In short they showed that the relation between the squares on the sides is an essential character of all right-angled triangles. The Pythagoreans were also the first to obtain general formulæ in pure number work; they discovered for instance that $1 + 2 + 3 + - + n = \frac{1}{2}n\ (n + 1)$, and they even had area numbers (*i.e.* a^2) and volume numbers (*i.e.* a^3).[1]

It is not too much to say that the Pythagoreans opened a new world to the Greek thinker. Here at last was a sphere in which man was completely master of his environment, for not only could he predict the effect of his actions but he could even give conclusive reasons for his predictions. Plato took geometry as the model for his philosophy, and Aristotle, who had little use for geometry as such, yet took from it the central idea that every effect has a cause, and that every cause can ultimately be expressed in terms of certain fundamental principles.

The reason why mathematics lends itself so successfully to this treatment is that its "objects" are themselves logical concepts. Of the many curves which exist in nature, the mathematician only selects those which appear to him to obey some definite law—the circle, the ellipse, and so

[1] Milhaud, *op cit.*

forth. With the aid of modern graphical methods he can even construct his own law, and then draw the curve which obeys it. But whether he begins with the law or with the curve, he is always dealing with an "object" which presents certain known properties, which are themselves the product of more fundamental facts. Hence, whatever property he discovers, he finds it possible to explain it in terms of other known properties, and is consequently justified in asserting that what he has found to be true in the particular form which he has examined must be true of all forms which obey the same law.

Moreover, when he seeks for the basis on which his science rests, he finds that it can be expressed in terms of perfectly clear postulates and axioms. In the world of mathematics, the student is free from the limitations which hamper him at every turn when he is dealing with objective reality. As he is not dependent on sense-experience, he does not run the risk of misinterpreting what he perceives; as he is not dealing with concrete objects, he need not be afraid that chance-variations will mislead him. And, best of all, he has logical concepts of all the forms with which he is concerned, and can consequently express every new property in terms of other previously established properties. For all these reasons the mathematician feels that he is, in his own sphere, a law unto himself. Whatever his problem, objective reality has nothing to do

with it. When he makes an assertion he can support it by facts which put its correctness beyond dispute. Add to this that the actual construction of a new idea is an unconscious process of which only the result becomes conscious, and it is not difficult to see why the study of mathematics gives those who have the necessary aptitude a feeling of power and independence which no other science can give to quite the same extent.

CHAPTER XIII

THE EFFECT OF CONSCIOUS CONTROL (*continued*)

(*b*) THE INDUCTIVE METHOD

Since the sixth century B.C., when Pythagoras and his disciples investigated the properties of form and number concepts, and showed that property could be explained in terms of certain fundamental principles, mathematics has become for us the model of what a science should be. To-day the ultimate aim of every pure science is to discover the fundamental principles which govern the behaviour of its objects of thought, and to explain observed properties in terms of these principles. But at the very outset the worker who deals with objective reality finds himself faced with a difficulty which the mathematician has not to encounter. The search for definite properties implies as a necessary preliminary the existence of classes which have these properties. In the case of pure mathematics this presents no difficulty, for the mathematician is only concerned with the curves and series which have been formed in accordance with some law of his own mind, and which consequently are, as it were, born as class concepts. But the matter is

not so simple for the student of objective reality, for he has to deal with objects which are in themselves merely a vast mass of miscellaneous entities, whilst his mentality is such that he is helpless until he has sorted and arranged them according to some principle or other.

Not that any investigator ever has to face the problem in this particular form. In actual practice even the first student of a new science starts with something more definite than a mere jumble of unorganised material, for every science develops out of an interest and every interest immediately leads to the growth of the corresponding psychological concepts. As Karl Pearson says, "we put meaning into phenomena," and we do this, not because we particularly want to do it, but simply because the tendency to see the old in the new forces us to classify each stimulus-set, as we experience it.

In practice the student of an objective science consequently finds his material classified for him in much the same way as the student of mathematics. But unlike the latter he cannot assume that his classes are correct, for they are only psychological concepts, and it is impossible for him to know without further investigation whether they represent a serviceable grouping of objects as they occur in Nature, or whether their development has been unduly influenced by one or other of the inborn tendencies which govern the growth of configurations. Moreover, the chances are that very little

has been done to discover the properties of the classes, and that even the little that has been done is only of doubtful value. Hence the first task of the student of objective science is to examine the classes which he finds in existence in order to determine their properties and, if necessary, to alter them sufficiently to make them represent something which actually does exist in Nature. Only then can he attempt to search for fundamental principles, to explain observed properties in terms of those principles, or to foretell what is likely to happen when a member of a known class is exposed to a new but known stimulus-set. Hence his interest is in the main directed towards the discovery of the properties of the classes which form the subject-matter of his science, or, as our anthropomorphic tendencies urge us to say, towards the discovery of the laws which govern their behaviour.

As we have seen, he always starts with a concept which he believes to be inaccurate or incomplete. His purpose is, therefore, to examine the individual members of the group, to see whether they really have the property which he believes them to have. He may have a theory that a colour-blind man tends to have colour-blind grandsons, a theory that the paths of all comets is of the nature of an ellipse, or again, a theory that all liquids expand when heated. If he wishes to examine the value of these theories, he obviously has to begin by collecting the necessary data. In some cases, such as colour blindness, he

will have to trust to the information he can obtain by means of a questionnaire. In others, such as the path of comets, he is not dependent on other people, but he is still dependent on forces beyond his control, and has consequently to make the best of such opportunities as come his way. Only in cases such as the expansion of liquids is he even theoretically master of the situation, for only in these can he reproduce the stimulus-set at will, and consequently repeat his observations as often as he likes. More than this, he can vary his conditions within wide limits, and can thus test the value of such conclusions as a particular result may seem to suggest.

It is usual to resort to experiment whenever the subject-matter lends itself to such treatment. Since experiment is a tool which the worker has to choose, if not to fashion for himself, much depends on the clearness with which he has realised the implications of his problem as well as on his knowledge and his constructive power. As Leonardo da Vinci told us long ago "Theory is the general, experiments are the soldiers. The interpreter of the works of Nature is experiment, that is never wrong; it is our judgment which is sometimes deceived, because we are expecting results which experiment refuses to give We must consult experiment and vary the circumstances till we have deduced general rules, for it alone can furnish us with them."[1]

[1] Quoted by Drinkwater, *op. cit*, p 27.

As the investigator examines one case after another, each result brings some answer to the question he has set himself. At times these answers may suggest the advisability of modifying the form of the experiment or of obtaining information from a fresh source ; but, if all goes well, there will come a moment when he feels that he has solved his problem. Then follows a careful re-examination of the material in the light of the new idea, and the formulation of a hypothesis which gives what seems to him the most probable solution But even now he cannot be sure that he has discovered an essential property of his class, for he has, of necessity, only examined some of its members.

At this point two lines of attack are open to him. He may test the value of his hypothesis by applying it to other members of the class, or he may set himself the task of showing that it is a necessary result of another property, which is known to be an essential character of the class he is examining. When the latter course is available, it is the more satisfactory, for it proves once for all that the worker has discovered a property of the whole class. But in practice this is often impossible, and he can, therefore, only determine the value of his idea by ascertaining its applicability to other members. Logically the hypothesis then remains a hypothesis to the end, for it is never possible to examine all existing specimens. But, owing to our tendency to expect every object to belong to a class which

has certain definite properties, it is usual to raise such a hypothesis to the status of a law when it has been shown to be true in a large number of instances.

This *process of discovering a property or law of a* natural class is technically known as the process of *induction*. Needless to say the amount of knowledge and ability that is required for work of this kind depends very largely on the type of the problem. The simplest are well within the range of the average schoolboy, the more complex can only be attempted by men of exceptional power, and even by these only after years of preparatory work.

I shall conclude with an account of the discovery of the Law of Evolution which will show far better than any general discussion what is actually involved in a complex case of induction. The account of Darwin's work is taken from the autobiographical chapter in *The Life of Darwin* by his son Sir Francis Darwin.

There was of course nothing new in the theory of evolution as such. The early Greek philosophers already taught that the world had evolved from a primordial substance by a process of transmutation and differentiation. But it is one thing to enunciate a general theory, quite another to provide material with the aid of which its value can be judged. Darwin tells us that his interest in evolution dated back to his adolescence. At the age of about sixteen he had heard Dr. Grant "burst forth in high admiration of Lamarck and his views on

evolution." He adds, "I had previously read the *Zoonomia* of my grandfather, in which similar views are maintained, but without its producing any effect on me. Nevertheless, it is probable that the hearing rather early in life such views maintained and praised may have favoured my upholding them under a different form in my *Origin of Species*."[1]

It was some eleven years later that he observed facts in South America which seemed to him to be inexplicable without the assumption that species are mutable. Thereafter the subject "haunted him," but he felt that it would be "almost useless" to try to prove the general truth of evolution, unless the cause of the change could first be discovered; that is to say, he felt that for his subject the mere collection of data would not be sufficient, and that he must, therefore, choose the second, more difficult line of attack. Observation of transmutations as they occur in nature are of little use for this purpose, because there is, as a rule, no means of ascertaining the exact conditions under which they took place. Darwin, therefore, set himself the task of discovering how breeders and gardeners produce new varieties of animals and plants. I give the rest in his own words. (The reader should note the effect of the chance reading of Malthus and the part played by unconscious construction in the discovery of the final solution.)

[1] *Op. cit.*, p 13

"My first notebook was opened in July 1837. I worked on true Baconian principles, and without any theory collected facts on a wholesale scale more especially with respect to domesticated productions by printed enquiries, by conversation with skilful breeders and gardeners, and by extensive reading. I soon perceived that selection was the keynote of man's success in making useful races of animals and plants. But how selection could be applied to organisms living in a state of nature remained for some time a mystery to me.

"In October 1838 I happened to read for amusement Malthus on Population, and being well prepared to appreciate the struggle for existence from long-continued observation of the habits of animals and plants, it at once struck me that under these circumstances favourable variations would tend to be preserved, and unfavourable ones to be destroyed. The result of this would be the formation of new species. Here then I had at last got a theory by which to work, but I was so anxious to avoid prejudice that I determined not for some time to write even the briefest sketch of it.

"But at that time I overlooked one problem of great importance; and it is astonishing to me, except on the principle of Columbus and his egg, how I could have overlooked it and its solution. This problem is the tendency of organic beings descended from the same stock to diverge in character as they become modified . . . I can

remember the very spot in the road whilst in my carriage when to my joy the solution occurred to me, and that was long after I had come to Down (*i.e.* after Sept. 1842). The solution, as I believe, is that the modified offspring of all dominant and increasing forms tend to become adapted to many and highly diversified places in the economy of nature." [1]

Meanwhile, Alfred Russel Wallace had come to the same conclusion on the basis of his observations in the Malay Archipelago. Whilst Darwin was carrying on his investigations in England, Alfred Russel Wallace was working at the same subject in the Malay Archipelago, where natural conditions are particularly favourable for the collection of suitable data. Independently of Darwin, he, too, came to the conclusion that variations are always occurring, and that the development of species adapted to the environment in which they live is due to the extermination of the unfit in the unending "struggle for existence" to which creatures are exposed under natural conditions.[2]

[1] *Op cit.*, p 40

[2] Strangely enough Wallace too was led to his theory of the survival of the fittest by Malthus's *Principles of Population*, which had made a great impression on him when he had read it twelve years previously and which some chance occurrence brought to his recollection at a time when his observations on existing species had already convinced him that species are mutable, and when he was, like Darwin, trying to account for what he had observed. See *My Life*, vol. i, ch. xxii.

Thus a new property of the class "living organism" was given to the world. But this was not all. Before the time of Darwin and Wallace the species which we find in nature were as a rule assumed to be separately created classes, each with its fixed properties, and each different from the others in ways which could be determined with as much certainty as the difference between triangles and circles. They were, in fact, conceived to be similar to the concepts which man forms in his effort to put meaning into his experiences. It was, of course, well known that variations are liable to occur, but these were usually dismissed as abnormalities, which could safely be disregarded by the biologist who was concerned with the systematisation of his subject-matter. With the discovery of the Law of Natural Selection all this was suddenly changed. Man realised, perhaps for the first time, that the laws of Nature are not necessarily the same as the laws of his own mind, and that the student of objective science cannot afford to neglect part of his data, because it will not fit into the classes which he has constructed from the rest To-day the biologist studies variations with the utmost care, for he realises that they will give him information which he cannot obtain from specimens which are true to type. He still classifies his material, for without classification it would become meaningless to him ; but he classifies it in the light of his knowledge of evolution, realising that each class is an abstraction

which he makes for his own convenience, and that the combined study of extinct and living organisms would often give him chains of organisms, which he could only divide into clear classes by wilfully ignoring certain transition forms.

I have taken the Law of Evolution as an example because the main facts are well known to everyone, but the general method of attack is the same in every other science.

Whatever the "object of thought" the only safe way is that of scientific induction. This necessitates (1) a clear formulation of a definite problem, either in the form of a question or in the form of a theory which is felt to be in need of proof or disproof, (2) the selection of suitable material and suitable methods of testing it, (3) the formulation of a hypothesis or "guess" on the strength of the results which have been obtained from the material, and (4) the testing of this hypothesis by reference to other members of the class. But, as we have seen in the case of Darwin's discovery of the Law of Natural Selection, and as could easily be shown from the work of other investigators, these are only the formal steps. In actual life the worker may have to wait until the solution of some part of his problem "flashes upon him" or until some chance occurrence, such as the reading of a particular book, gives him the links for which he has been looking.

Note on Mathematical Induction

A discussion of mathematical induction would take us beyond the scope of our subject. It is, however, important to realise that mathematical induction is not merely a particular case of the logical induction which we have been discussing in this chapter. I add a short quotation from Bertrand Russell's *Introduction to Mathematical Philosophy*, to which reference should be made in this connection :

" The use of mathematical induction in demonstration was, in the past, something of a mystery. There seemed no reasonable doubt that it was a valid method of proof, but no one quite knew why it was valid Some believed it to be really a case of induction in the sense in which that word is used in logic. Poincaré considered it to be a principle of the utmost importance by means of which an infinite number of syllogisms could be condensed into one argument We now know that all such views are mistaken, and that mathematical induction is a definition, not a principle. There are some numbers to which it can be applied, and there are others . . . to which it cannot be applied. We *define* the ' natural numbers ' as those to which proofs by mathematical induction can be applied, *i e.* as those that possess all inductive properties. It follows that such proofs can be applied to the natural numbers not in virtue of any mysterious

intuition or axiom or principle, but as a purely verbal proposition. If 'quadrupeds' are defined as animals having four legs, it will follow that animals that have four legs are quadrupeds, and the case of numbers that obey mathematical induction is exactly similar."

CHAPTER XIV

THE CONCEPT AS A TOOL

(*a*) THE DEDUCTIVE METHOD

In the last three chapters we have been studying the growth of concepts. In this we shall be concerned with their use. Concepts are from their very nature tools. We develop them because they help us to solve our problems, and we use them as a matter of course whenever there is a difficulty to overcome. When a tool proves unsatisfactory, there are two courses open to us (1) to examine the tool to see whether it could be made more serviceable, or (2) to examine the object to see whether we should perhaps be more successful with a different tool. Applied to concepts this means that we may (1) examine the class for which the concept stands to see whether we have formulated its properties correctly, or (2) examine the particular case with which we are dealing to see whether we have put it into the wrong class and are, consequently, expecting it to have properties which it has not got. The former of these is already familiar to us. It is the *inductive method* which we were studying in the last chapter. The latter will form

the subject-matter of this chapter. It is what is technically known as the *deductive method.*

The difference between the two methods of investigation is primarily one of purpose. It may be stated as follows. In induction the properties of the individual cases are assumed to have been ascertained correctly, and the aim is to discover some essential character of the class to which they belong. In deduction the essential characters of the relevant classes are assumed to be known correctly, and the aim is to use them to discover the properties of a particular individual. To put the same thing in different words The process of *induction* is concerned with the discovery of the essential properties of a class concept, the process of *deduction* is concerned with the interpretation of a problematic individual with the aid of such class concepts as are available.

When an individual has to solve a problem for the first time, he may of course merely imitate the behaviour of another. But if he solves it without such help, then the act always involves the interpretation of the stimulus-set with the aid of such knowledge as is available—that is to say, it involves true deduction. However, if the problem is encountered frequently, recall of previous solutions is presently all that is needed, and a little later even that disappears, leaving only a more or less mechanical interpretation of the stimulus-set. Cases such as these may involve conscious recall,

recognition or perception, but they do not involve deduction because they no longer necessitate original constructive work.

The simplest form of deduction is that in which a specimen has to be examined in a prescribed way in order to classify it and in which the required property is one of the known properties of that class. The botanist who has to classify a plant knows exactly what points matter. He is therefore able to set himself a series of definite problems, and to use his results to decide beyond doubt to what class the plant actually belongs. In the same way the chemist applies definite tests to the substance he wishes to name, and interprets the results he obtains with the aid of previously discovered rules. Testing the truth of a scientific "law" by reference to other individuals of the same group is another instance of this form of deduction.[1]

Investigations such as these depend for their success partly on the possession of the necessary knowledge and technique and partly on the ability to interpret the results that are obtained. They are in short acts of interpretation, and as such need not detain us here.[2]

But when a phenomenon presents characters which do not yield to ordinary methods, difficulties arise which have not been considered yet. It is this more complex type of deduction which will form the subject-matter of this chapter.

[1] Cf. p. 275. [2] Cf *Interpretation*, in Ch IX.

The Classification of the Problematic Unit

In order to have a concrete example it will be convenient to centre the first part of the discussion round the discovery that malaria is due to a parasite which requires a mosquito for its development.

Tradition has always associated malaria with marshlands, and it was generally supposed that miasma, invisible animal life or insects, more particularly mosquitoes, were in some way carriers of the disease; but, as far as actual facts were concerned, any one of these seemed just as likely or unlikely a cause as any of the others. The first definite investigation was attempted early in the eighteenth century, when Lancisi examined the air of marshes under a microscope in the hope of finding the actual cause, but without success. Researches of this nature "represent all the work that could be done in those days with the physiological and pathological knowledge then existent, the means of research then at command, with the 'humoral' theories[1] then prevalent, and the speculations which dominated thought, but had no foundation in facts."[2]

[1] I e the theories which ascribe all disease to alterations in the fluids or 'humors' of the body

[2] *Twentieth Century Practice*, vol. xix, p 7

In the latter half of the nineteenth century the study of diseases which were caused by parasites led a number of scientists to the conviction that malaria would be found to belong to this class, and after many vain efforts on the part of others Laveran at last discovered the actual parasite in the blood of a malarial patient. During the following years its later life-history was worked out in detail, but this was of little practical use so long as its origin was still unknown. However, in 1894 Sir Patrick Manson discovered that a mosquito acted as intermediate host in the case of filariasis—another disease of which the history had previously been unknown. This turned the mosquito theory from one of a number of vague beliefs into a working hypothesis, which was worthy of serious consideration, with the result that prompt measures were taken to test its truth. And in 1895 Major Ronald Ross was able to announce that he had discovered the mosquito which acted as carrier in malaria. After this it was obvious that a district could be rendered free from malaria by making it unsuitable for this variety of mosquito, and since it was well known that mosquitoes can only breed in stagnant waters it was clear that this could be achieved by draining the pools and swamps of the neighbourhood.

In this investigation the stimulus was the desire to prevent malaria, but to prevent a disease it is necessary first to know its cause, and to discover its

cause it is necessary to know enough about its symptoms to be able to recognise it with some degree of certainty. At times the available information is too unreliable to be of much use, with the result that the "problematic unit" has to be examined with the aid of observation and experiment before any progress can be made. And when this unit is itself a class (as for instance in malaria) the discovery of its properties may in turn depend on a series of investigations by the inductive method. Malaria had, however, been studied for many centuries, and what was known about its properties (*i.e.* symptoms, treatment, etc.) was therefore sufficient to form a useful starting-point for the investigation. As a matter of fact the inductive method was used after the time of Laveran to discover the properties of different forms of the disease, but that part of the investigation does not concern us here. For our purposes it will be sufficient to confine ourselves to the main line of attack.

As has just been shown, this fell into two parts, (1) the search for the parasite in the blood of patients who were suffering from malaria and (2) the search for the method by which the parasites entered the human organism. In both cases the new line of thought was suggested by an increase of knowledge in allied fields of investigation, but it was only suggested as a working hypothesis, whereas the fact that the drainage of the marshes would put an end

to the disease followed as an obvious inference, once the mosquito was known to be the carrier. The difference is due to the difference in our state of knowledge. It is known beyond doubt that mosquitoes only breed in stagnant water. This is, therefore, an essential character of the class and can consequently be assumed to be true of every one of its members. But too little was known about the essential characters of parasites to know whether, *e g.*, a disease which was in some respects like those which were known to be due to parasites must, for that reason, also be like them in origin. Hence the increase in knowledge could only provide a working hypothesis, which had to be tested before it could be accepted as correct.

Another point to notice is the part played by a working hypothesis in guiding experiment and observation. We saw that Lancisi failed because he was misled by the theories which were prevalent in his time, and that Laveran and Ross succeeded because they were working with a hypothesis which suggested the right line of attack. But we also saw that Laveran succeeded where others failed. The value of a hypothesis is that it confines the investigation within reasonable limits by giving rise to a few definite questions. But to formulate these questions in the best way, and to plan suitable observations and experiments, are acts which involve interpretation and construction, and their success will therefore depend on the knowledge and technique

of the worker as well as on his constructive ability, and on the extent to which he is free from hindering inhibitions.[1]

Finally, the classification of malaria as a disease which is carried by mosquitoes is worth examining from the point of view of the amount of information that could be derived from it. We may take it that the fact has been established beyond doubt. Can we then infer from it that malaria can only be carried by mosquitoes? The answer is that it is highly probable, but not absolutely certain. Can we infer that the extermination of the mosquito is the only real safeguard? The answer is that it is the only safeguard which is available at the moment, but that there may be others which we have not yet discovered. In both cases the uncertainty is due to the fact that we do not know enough about the habits of the parasite. Where the laws are known, there we can deduce the behaviour of the individual case with absolute confidence, once we have classified it correctly. But as soon as we trespass into the unknown, we have to resort to experiment and observation, if we wish to ascertain what is and what is not possible.

The Discovery of the Required Property

The more we know about the "laws" or properties of a class concept, the more independent do

[1] Cf Ch. IX.

we become of experiment and observation. In the extreme case both the problematic unit and the classes into which it is to be placed are one and all logical concepts, and there is consequently no need to resort to experiment to discover their properties. This is true of mathematics, and to a lesser extent of

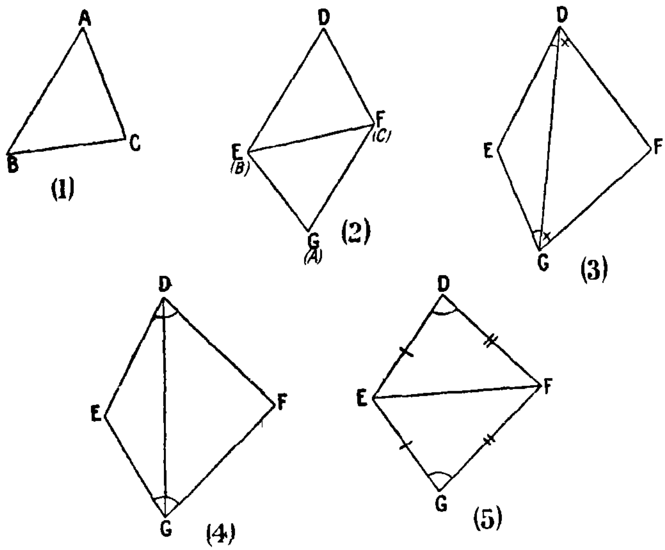


FIG 9

physics. The long chains of reasoning which form the attraction of this type of work are rendered possible by the large stock of logical concepts which the investigator has at his disposal. When he has classified his object of thought as, say, an isosceles triangle, he knows exactly what properties he can

assume it to have, and when he has deduced from this effect that the angles at the base of the triangle must be equal, he can use this new fact in further investigations. As an example we can take the well-known theorem that two triangles are equal in all respects, if they have their corresponding sides equal.

The reader will remember that the construction consists in placing Δ ABC into the position EFG and joining the line DG and that the proof depends on the realisation of the facts shown in (3), (4), and (5) of Fig. 9. The difficulties that the discovery of such a proof presents we have already discussed in connection with interpretation and the growth of concepts. Here we are concerned with the extent to which the solution depends on the possession of the necessary logical concepts. It will be worth while to work this out in detail: In Fig. 9 (3) the angles which are marked equal are known to be equal, because the triangles are isosceles, and because it is the property of isosceles triangles to have the angles at the base equal. In Fig. 9 (4) the whole angle at D is known to be equal to the whole angle at G, because it follows directly from the axiom that if equals be added to equals the results are equal. And in Fig. 9 (5) the triangle EDF is equal in all respects to the triangle ABC, because it is a property of triangles which have two sides and the included angle equal to be equal in all respects. If there is any doubt about the assump-

tion on which the results obtained in (3) and (5) are based, they can in turn be shown to depend on other properties, and ultimately on the axioms and postulates on which the whole science is based. To resort to experiment after this would be sheer waste of time, the proof has placed the fact beyond dispute for anyone who knows what a logical concept means, the only concepts that are left open to attack being the axioms and postulates on which the whole structure has been reared. On the other hand it is clear that this type of proof is only possible when the necessary "laws" or "properties" are available. In a science like biology long chains of reasoning are out of the question, because we are continually held up by the incompleteness of its concepts. In a science like geometry they are possible, because it depends entirely on concepts whose essential properties are known.

We have defined the deductive method as the interpretation of individual cases with the aid of class concepts whose properties are supposed to be known. It will be evident from what has been said that this really involves two processes, (1) the classification of the problematic unit and (2) the deduction of the required property from the properties of the class to which it belongs. In an experimental science such as biology the problem is in the main one of classification, and such deductions as can be made are usually fairly obvious. In a deductive science such as geometry, on the other

hand, the classification is usually a simple matter, and the main problem is the deduction of the required property, with the aid of various combinations of known properties.

To sum up, the complete deductive method would seem to involve the following steps·

(1) *An examination of the problematic unit in order to determine which of its properties are likely to be helpful.* This may take place according to a prescribed plan, or it may involve the use of the inductive method on the lines which were indicated in the last chapter.

(2) *The classification of the unit with the aid of the results that have been obtained.*

When the problematic unit seems to fit into none of the known classes its classification involves

(*a*) The formulation of a hypothetical classification in the light of such information as is available.

(*b*) The planning of suitable observations and experiments to test the value of the hypothetical classification, and

(*c*) The acceptance or rejection of that classification on the basis of the results which have been obtained from (*b*).

(3) *The deduction of the property that is required from the known properties of the class to which the unit has been found to belong.* The amount that can actually be deduced depends on what we know

about (*a*) the essential characters of the class and (*b*) the relation of that class to other classes. In a deductive science long chains of reasoning can be built upon one classification. In an experimental science a chain of reasoning is usually short because lack of knowledge is continually driving the worker back to experiment and observation for the discovery of the data which he requires for his deductions.

CHAPTER XV

THE CONCEPT AS A TOOL (*continued*)

(*b*) THE LOGICAL FICTION

When we were discussing the process of classification in the last two chapters, we assumed tacitly that there is always some one class to which the problematic unit belongs for the purpose in hand, and that the properties of that class will consequently give the solution that is required. In the case which we took the end in view was the prevention of malaria and to achieve this it was necessary to discover the cause, that is to say, it was necessary to classify the disease from the point of view of origin. This intermediate step involved lengthy and difficult investigations, but, once it was known that malaria belonged to the class of " diseases which are carried by mosquitoes," the rest followed immediately from the known characters of the mosquito.

Suppose, however, that the problem is the prevention of drunkenness in a country in which prohibition cannot be enforced. Malaria is due to a definite parasite which has ascertainable habits of life. But drunkenness may be due to a number of different causes and combinations of causes, every one of which will have to be considered separately Hence

there is no one class to which it belongs for the purpose in hand. Or suppose, again, that it is necessary to decide what standard of work should be expected from the pupils of a given age. To decide this we need to know the amount of knowledge and power which a pupil of that age can be expected to have acquired. But this in turn depends on differences in ability, health, opportunity, and interest, and it is therefore impossible to find some one standard of work for so large and so complex a group. These are not isolated instances. On the contrary, reflection shows most of our social problems are in actual fact too complex for the direct application of the methods of induction and deduction. All the same, the special difficulties which they present have usually been passed over in silence, until Vaihinger drew attention to their importance in his work entitled *The Philosophy of 'As if.'* Vaihinger points out that we overcome this difficulty in practice by limiting the problem artificially. We confine our investigation into the causes of drunkenness to individuals whose wages are low and whose physique is poor, and our investigation into the standard of work which should be attained at a given age to children who have reached a particular form in a particular type of school. In this way we obtain problems which are definite enough to be amenable to solution by means of induction and deduction. If the type of school is the average school of the district, the

results that have been obtained can be taken to represent the average standard of that district, and this standard can then be used to deduce such things as the curriculum and organisation which are likely to prove successful throughout that district In other words the problem has been thrown into a form in which it can be solved by using the average to represent the whole. Such an artificial limitation of a problematic class Vaihinger calls a *logical fiction.*

In a sense every concept is a "fiction," for it is an abstraction which has no existence outside the mind which fashioned it. Moreover, most of our concepts are also fictions in the sense that they give an incorrect or incomplete characterisation of the group for which they stand. But the logical fiction alone is known and intended to be an incorrect representation of reality. It is, moreover, not meant to become part of the permanent stock of knowledge It is a tool which the worker has constructed for a special purpose and which he intends to discard as soon as he is able to do without it. In short the logical fiction is a logical concept which is known to be incorrect, and which owes its value to the fact that it enables us to handle problems which would otherwise overwhelm us with their complexity.

The logical fiction is still a comparatively new tool of thought and it is at present not used as widely as it might be, but there seems reason to believe that

it will prove of immense value in the solution of social problems when its value has become more generally recognised. We owe the first scientific investigation of its possibilities to Vaihinger, to whose work *The Philosophy of 'As if'* the reader is referred in this connection. All that can be attempted here is a rapid survey of the whole field.

Different Types of Logical Fictions

In order to make this survey as complete as possible it will be convenient to group logical fictions according to the mental processes on which they depend.

Considered from this point of view we can distinguish four different types:

(1) That which treats some one character of a concept, as if it were the only character, *e.g.* "the economic man," "the frictionless pulley."

(2) That which treats a type, as if it were an adequate representation of a complex group, *e.g.* "the average child," "the civilised man," "the Utopian."

(3) That which treats some one group of characters, as if it included all the characters of the unit, *e.g.* "the state as an organism," "the child of to-day as the citizen of to-morrow."

(4) That which personifies an unknown "something," the existence of which our mental make-up causes us to infer from our observation, *e.g.* force, engram, liberty, sympathy.

Of these the first three give us artificial simplifications of problems which would otherwise be too complex to handle.

Fictions of the First Type

The fiction of the economic man, for instance, assumes a being who is only interested in his own material welfare. This may be true here and there, but for most of us wealth is only one of many desires, and in practice it is not even necessarily a vital desire once the individual has enough for his personal needs. The fiction that man is entirely self-interested should, therefore, lead to deductions which are not in accordance with reality. Yet Adam Smith was able to build up his epoch-making *Wealth of Nations* on the assumption that "the natural effort of every individual to better his own condition when suffered to exert itself with freedom and security is so powerful a principle that it is alone and without any assistance, not only capable of carrying the society to wealth and prosperity, but of surmounting a hundred impertinent obstructions with which the folly of human laws too often encumber its operations."[1] And what is more, his more important conclusions have all stood the test of time. Marshall says: "Wherever he differs from his predecessors he is more nearly right than they, whilst there is scarcely any economic truth now known of which he did not get some glimpse. . . . The area which

[1] Book iv, ch v

he opened up was too vast to be thoroughly surveyed by one man. . . . It is therefore possible to quote his authority in support of many errors, though on examination he is always found to be working towards the truth."[1]

Thus Adam Smith was able to obtain correct results by means of deductions, which were based on an incorrect fiction. The reason lies in the nature of the subject-matter; for it is true enough that profit is normally the dominant desire, whilst a man is actually engaged in buying or selling, and the fiction of the economic man is, consequently, a perfectly sound basis for the development of the fundamental laws of demand and supply. But the position is different when we attempt to use it, say, to study the laws which govern co-operation or the effect which labour-saving devices are likely to have on unemployment. In these more special problems the desire for gain is no longer the dominant factor, and deductions which are based on it alone are, consequently, bound to produce incorrect results.

The economist who studies this type of problem has, therefore, to consider man as he "really" is. This means in practice that he has to begin by investigating how groups of individuals have behaved in the past in situations similar to that in which he is interested. With the aid of the inductive method he has then to formulate the hypothetical "laws" which their behaviour suggests.

[1] Marshall, *Principles of Economics*, Ed 1920, pp. 757–8.

And it is only after all this preliminary work that he can use the deductive method, in much the same way as the biologist uses it, to discover what seems the most likely solution of his problem "Thus in every way economic reasoning is now more exact than it was, and the premisses assumed in any enquiry are stated with more rigid precision than formerly. But this greater exactness of thought is partly destructive in its action; it is showing that many of the older applications of general reasoning were invalid, because no care had been taken to think out all the assumptions that were implied, and to see whether they could fairly be made in the special cases under discussion . . . This destructive work . . . has cleared the ground for newer and stronger machinery, which is being steadily and patiently built up. It has enabled us to take broader views of life, to proceed more surely though more slowly, to be more scientific but much less dogmatic . . . The change may perhaps be regarded as a passing onward from that early stage in the development of scientific method, in which the operations of Nature are represented as conventionally simplified for the purpose of enabling them to be described in short and easy sentences, to that higher stage in which they are studied more carefully and represented more nearly as they are, even at the expense of some loss of simplicity and definiteness and even apparent lucidity."[1]

[1] Marshall, *op cit* pp 765-6

In short the fiction which assumes that the dominant character of a unit is its only character, enables us to bring order into chaos by giving us a fundamental principle with the aid of which we can at any rate make a preliminary survey of what was previously just a confused mass of data. All the same the fiction is only an expedient and its value depends on the extent to which it draws attention to the characters which happen to be essential for the problem under discussion. The assumption that everyone in pursuing his own advantage at the same time furthers the good of all led to valuable results in investigations concerned with the marketing of supply and demand. It led to lamentable results when it was used by the successors of Adam Smith to prove that the factory owner should be allowed to employ labour under whatever conditions he thought best. This was a case in which the interests of the individual did not necessarily correspond with those of his fellows, and for which Adam Smith's fiction was consequently inadequate.

Fictions of the Second Type

After this lengthy analysis of the first type of fiction, the second and third need not detain us long, for the same line of argument will be seen to apply in each case.

As an example of the second type I shall take the

fiction of the "average" child. There has probably never been a child who had all the properties which education authorities consider "average" for a given age, yet the assumption is perfectly legitimate when the average is calculated from a fairly homogeneous group, for it gives what is wanted for the purpose, namely, the dominant characters of that group. And the fiction is also necessary, for school organisation would present a series of insoluble problems without some such assumption. When it fails to produce desirable results, the reason is that it has been mistaken for the objectively real, and the individual children have consequently been expected to fit into a framework which should have been used to discover their individual deviations from it.

Fictions of the Third Type

Fictions of the third type are like the last dependent on the artificial selection of a group of properties to the exclusion of the rest, the selection being guided by the desire to draw attention to some aspect of the complex whole which might otherwise be neglected. In practice the selected properties are, as a rule, some or all the essential characters of another concept and the fiction is therefore readily expressed in metaphor or simile. By calling the state an organism we call attention to the interdependence of its members; by calling a child the future citizen we draw attention to the interest the

state should take in his education. In both cases the fiction leads to the formulation of problems which might otherwise have been overlooked, and in both cases the concept (*i.e.* organism, citizen), with which the problematic unit (*i.e.* state, child) is being compared, itself suggests properties which are likely to aid in the solution of the problem. But here again the fiction may suggest all kinds of absurd deductions, if its limitations are not borne in mind with sufficient care. though the members of the state are undoubtedly dependent upon each other, their interdependence is far less direct than that of the organs of the body, and their power of resisting unreasonable demands is very much greater. In the same way the child is not only the citizen of to-morrow, he is also an individual with manifold personal needs, and, if the word citizenship is interpreted at all narrowly, there is good reason to fear that education for citizenship alone will stunt growth in directions which are ultimately just as important.

To sum up A logical fiction which is based on the artificial selection of one or more properties is a safe basis for deduction, if the selected properties are dominant for the purpose in hand. But it is liable to mislead the thinker, if it emphasises what is unimportant or omits what is important.

Fictions of the Fourth Type

We have still to consider the fiction which personifies an unknown "something" the existence of

which we infer from our observations. The term "engram" is a good instance of this. Semon says. "When an organism has been temporarily stimulated and has passed after the cessation of the stimulus into the condition of secondary indifference, it can be shown that such organism—be it plant, protist,[1] or animal—has been permanently affected. I use the term engram to denote this permanent change wrought by a stimulus."[2]

What, then, is an engram? All we can say is that it is a change wrought in the organism, a change which causes the organism to react differently when the stimulus is repeated. If we are asked to describe that change, we can say little or nothing about it. Semon calls it "an altered disposition of the irritable substance."[3]

Yet we give it a name, and treat it as though it were an entity which is formed within the self and is thereafter able to influence the behaviour of that self, whereas it is in reality nothing more than a shorthand formula for the change which is wrought within an organism by the action of a stimulus. In the same way the word "force" is a shorthand formula for "that which produces movement," the word "cause" for "that which always precedes an observed change," and so forth. Vaihinger says "While formerly these ideational constructs were taken to be the expression of real things, to-day they

[1] I.e., unicellular organism.

[2] *The Mneme*, p. 24.

[3] *Op. cit.*, p. 39.

are regarded as mere abbreviations, as the comprehensive expression for a series of inter-related phenomena and processes. Moreover, all the more specific forms are to be included here, such as gravitation which Newton himself only looked upon as a fiction. The phemomena are of course real, but the attribution to them of gravitational force is simply a summary expression for the regularity of the phenomena "[1]

And of causality he says, "To-day at least this idea has sunk to the rank of a mere word for the philosopher, whereas previously everything was regarded as understood, if it could be brought under the category of causality."[2]

It is interesting to speculate how these fictions have acquired the attribute of concreteness with which popular usage endows them as a matter of course. To the philosopher a force may be "a summary expression for the regularity of certain phenomena." To the person who is not given to philosophical analysis, it is more likely to be a mysterious power which an object acquires in some unknown way when it is, say, falling to the ground. He drops a knife from a height, and sees it bury itself in the hard ground. It is clear that that knife has gained a property which it had not got before and he calls that property "force." The reader will see that this is the primitive attitude of the mind towards its environment. When man discovered

[1] *Op cit*, p 367 [2] *Op cit*, p 37

that he could not cause things to move themselves by a mere act of will, he endowed first his great men, then his gods, with that power. Later the gods were replaced by some principle or power which only differed from them in being less anthropomorphic, and it is an entity of this nature that we still expect to be responsible for every change which we observe. However this may be, there can be no doubt that it requires a definite effort of will to realise that engram, force, energy, ether, and so forth are only shorthand formulæ for observed phenomena. For practical purposes they remain entities which have certain definite properties.

The same is true of the ethical properties with which we endow human beings. We talk of freedom, strength of will, egotism, and so forth, as though they were concrete entities like tables, books, and chairs But in reality these too are nothing more than convenient shorthand formulæ. When a person is able to hold his own in the face of obstacles we call him "strong-willed", when he feels he is master of his own fate he says he is "free." In both cases all we have done is to replace a lengthy statement by a single word; we have explained nothing. The value of concepts such as freedom and strength of will is that they direct our attention to important aspects of human behaviour. In fact, their function is similar to that of the metaphor. They too stand for a group of qualities, but since

there was no suitable concept available a special word had to be coined for them.

As is well known, man thinks in metaphor long before he begins to think in terms of the abstract. "To minds in this mythologic stage," says Tylor, "the curse becomes a personal being, hovering in space till it can light upon its victim; Time and Nature arise as real entities; Fate and Fortune become personal arbiters of our lives. . . . Entering into the mind of the old Norseman, we guess how much more meaning than the cleverest modern imitation can convey, lay in his picture of Hel, the death goddess, stern and grim and livid, dwelling in her high and strong barred house, and keeping in her nine worlds the souls of the departed; Hunger is her dish, Famine is her knife, Care is her bed, and Misery is her curtain. When such old material descriptions are transferred to modern times . . their spirit is quite changed. . . We call it quaint humour when Charles Lamb, falling old and infirm, once wrote to a friend, 'My bed-fellows are Cough and Cramp, we sleep three in a bed.'"[1]

It is probably the desire for greater reality adaptation which has caused the abstract term to replace the metaphor in modern thought, for it is undoubtedly the better tool for thinking. And this not on account of its abstractness as such. As we have seen, it is only by a conscious effort, and then

[1] Tylor, *Primitive Culture*, vol ii, p 301

only for a short time, that we can bear in mind that words like will and force do not stand for a concrete "something." In this sense it is, therefore, as far from objective reality as the metaphor. The superior value of the abstract term is due to the fact that it carries less meaning and is consequently less liable to lead the thinker astray. The class "knife," for instance, has many characters besides the power to kill. Hence when we are told of Hel that Famine is her knife the phrase carries several potential meanings, if we do not know who Hel was, and many more, if the word Famine is also unfamiliar. On the other hand the phrase "power to kill" has a definite meaning, even if both the other terms happen to be unknown In problem solving and in scientific discussion we need accuracy above all things, and for this kind of thinking the abstract term is therefore preferable to the metaphor. But it needs distinct effort to bear in mind the particular group of qualities for which a new term stands. When our purpose is self-expression rather than reality adaptation, we consequently prefer to use a metaphor, if there is no familiar abstraction available. We expect the scientist to coin a new word for new groups of qualities and feel that his exposition is vague when he resorts to metaphor, but we expect the poet to use a metaphor to reveal a new thought and resent as disturbing the intrusion of an unfamiliar word.

To sum up, the abstract term, and for that matter

the general term, are labels which we give to groups of qualities which we have centred round an unknown "something." Thus "liberty" is the name for a group of properties, "weapon" for a group of objects In so far as these terms have not been raised to the status of logical concepts, they are clearly fictions and their value in problem solving is, therefore, dependent upon the same conditions as that of the metaphor and the type. Hence they are of use to the thinker, if they suggest properties which are dominant for the purpose in hand, but they are certain to hinder him, if they emphasise what is irrelevant or of negligible importance. To attain their full value as tools abstractions must, therefore, be formulated as logical concepts or logical fictions. In practice the formulation of a logical concept is often beyond our power, but it is always possible to state clearly what properties a particular term is meant to convey for the purpose in hand, and that is, as we have seen, the essence of a logical fiction.

The Use of Fictions in Daily Life

In conclusion it will be worth while to turn for a moment to the part played by fictions in the thinking which we do in the course of our daily life From what has been said it will be evident that most of this thinking depends on the use of fictional concepts. Yet we are rarely aware of the fact Not only do we use fictions as though they were concepts, but

we cheerfully use the same word in different senses without being aware of what we are doing. The more complex the unit, the more likely is this to happen, and the result is often an unending discussion, when a clear definition of the terms would quickly put an end to the dispute Only in legal matters are we accustomed to realise the existence of fictions. We are taught that every one is treated *as if* he knew the laws of his country, and that the defendant who does not put in an appearance is regarded *as if* he admitted the charge. But apart from a little practical instruction of this nature, nothing is done to help us to realise the legitimate scope of the fictions we are using Yet this is clearly an essential part of our education, if we wish to make the best of such ability and knowledge as we have got; for the problems of daily life often involve factors which are too complex to yield to any other form of attack, and the success with which they are solved must, therefore, depend on the skill with which suitable fictions are selected and handled.

CHAPTER XVI

BELIEF AND THE SEARCH FOR REASONS

THE words belief and knowledge carry a number of meanings. In what follows I shall confine the term "belief" to information which is accepted without investigation on account of the source from which it comes, and the term "knowledge" to information the acceptance of which depends on some form of problem solving. Thus a statement is *known* to be true when it has been explained in terms of the real or supposed properties of the object about which it has been made, it is *believed* to be true when the prestige of the source from which it has been derived is such that an attempt to prove it in reference to the properties of the object seems the merest waste of time.[1]

THE FEELING OF CONVICTION

One important characteristic of a whole-hearted belief is the feeling of conviction which it produces within the believer when it is challenged. Intro-

[1] This excludes the use of the term "belief" for something which is probable, but not certain, e g I "believe" this to be the right house, but I am not sure about it

spectively this feeling would appear to be somewhat more urgent and dynamic than the feeling of certainty which accompanies the defence of a known fact, but the two experiences are undoubtedly similar, and it may be that this is the reason why the strength of the feeling of conviction which a belief produces is often taken as a measure of its soundness. As a matter of fact there is, however, no necessary connection between the two; for an idea seems convincing whenever it is able to become conscious without experiencing blockage in the process, that is to say, whenever it has psychological reality for the mind within which it occurs. But this by no means proves its reality value. In fact, it does not even prove that the cause of an erroneous belief is necessarily ignorance. If a person holds a statement to be true when it is objectively untrue, all we can assert is that he was not at the time aware of any reason for disbelieving it.

Sometimes such blockage is produced by the activity of the dominant desire, as in the case of the person who conveniently but honestly "forgets" an engagement when he wants to be doing something else and, consequently, announces in perfectly good faith that he is "quite free" to do what he wants to do. A known fact may, however, fail to appear in consciousness when there is no conflict of desires involved. A person may, for instance, accept a traveller's tale as correct when certain features of it are quite incompatible

with what he knows of the geography of the country. This kind of thing is liable to occur whenever the inhibiting idea belongs to a system which has no interest in common with that which is being ecphored at the time and has, consequently, never been incorporated within it. If the individual thought it necessary to test what he has been told, the ensuing investigation would no doubt lead to the discovery of the common element. But it would seem that a new link is only formed in response to constructive effort, and that a stimulus-set is only able to ecphore configurations as it finds them.[1] *In other words, an engram-set is* non-existent for practical purposes, if it does not already belong to the configuration which is being ecphored, and the idea to which it would give rise, if stimulated, is consequently unable to affect behaviour, because its system cannot be rendered active. It is this tendency to think in water-tight compartments which makes it possible to hold incompatible beliefs without becoming aware of the fact.

The Belief as a Valued Possession

When the value of a belief is challenged, the first reaction is often one of resentment, the challenge being understood as an attack on the ability of the

[1] Cf p 169

believer. And this is of course exactly what it is, for it implies either that he has interpreted an experience wrongly, or that he has chosen a leader badly. Needless to say a person of normal intelligence has realised both these possibilities long before he reaches adult life, but even so enough of the infantile belief in the self seems to survive to make this feeling of resentment a fairly common occurrence.

This attitude of mind is even more common when a person has had the worst of an argument. To own to a defeat under such conditions is an excellent proof of self-control. In practice we find again and again that the weaker of two disputants breaks off the discussion in a temper, or even offers to fight his opponent for daring to assert that he does not know what he is talking about. In other words, he treats his belief as a possession which has to be protected in much the same way as a mother protects her child. To convince such a person that his belief is not in accordance with objective reality is by no means an easy matter. The fact that he protects it so vigorously proves that it satisfies a strong need within him, a need which is the expression of a dominant complex, and which is for this reason able to block ecphory within all rival configurations. Hence the only way to deal with him is to awaken within him some other desire which will produce a different form of blockage, and will thus enable him to consider the other side of

the question. If the belief is one which derives its energy from a powerful source, the resulting conflict may, however, be extremely painful.

Instances of this will be found in the biographies of many reformers, for a worker who wants to change the behaviour of a group is of necessity in conflict with the accepted beliefs of his time—whether they be religious, political, or social—and is, therefore, often compelled to relinquish an idea which he has derived from an influential source. As an example of the strain which such a conflict may produce we may take Luther's account of his struggle. Defending the hesitation which characterised his attitude at first, Luther says .

"Who was I, a poor miserable monk, that I should make head against the majesty of the Pope, before which the kings of the earth (nay, earth itself, hell and heaven) trembled. What I suffered during the first and second year ; into how deep a dejection I fell—no imaginary or affected dejection, but a regular prostration of mind, or rather utter despair—cannot be conceived by those who, with easy confidence, have since rushed along the beaten road to attack the Pope with such fierceness and presumption. . . . Had I then braved the Pope as I do now, I should have expected the earth to open and swallow me up on the spot, as it did Korah and Abiram "[1]

[1] *Life of Luther, written by himself, collected and arranged by Michelet* Translated by W Hazlitt, 1846, pp 67–8

The Sources of Belief

There are two sources from which we derive our beliefs (1) our own personal experiences and "intuitions" and (2) the assertions of persons or groups of persons to whom we are for some reason suggestible

Our belief in the reliability of personal experience and intuition is no doubt a direct product of the self-preservative tendencies, for we would clearly not think it worth while to attempt to put meaning into our experiences, if we did not trust the evidence of our own senses, nor would we attempt to overcome obstacles, if we had no confidence in the solutions which our unconscious constructive power evolves for us. At the same time our belief in our own powers is, as we have seen, liable to mislead us, if we do not allow for the blockage which is produced by the activity of contrary desires and by the systems of water-tight compartments which are the product of insufficient or unskilful organisation.

The second source of belief owes its existence to our suggestibility. This is a factor which has not been considered so far, and will consequently have to be discussed in more detail

If we examine, each of us, the stock of information which we have at our disposal, we shall find that by far the larger part of it has been accepted uncritically from others. We assert confidently that we know that dirt breeds disease, or that we know that Columbus

discovered America. But, as a matter of fact, all that we really know about these and many other things is that they are held to be true by some person X whom we respect, or by some group Y to which we belong. All the same we accept them as part of our stock of tools, and allow them to influence our behaviour, for it seems unthinkable that X should give us information which is not reliable, or that our group should hold an opinion which is not correct.

This tendency to accept information on trust may at first seem to be in direct conflict with the child's undoubted desire to find out things for himself. But that is not how it works out in practice. For the urge to put meaning into every new experience, and the desire to find a way out of every obstacle to progress, between them create a multitude of needs which it would be impossible to satisfy without the power of learning from others. Do lions climb trees? Do walruses swim slow or fast? How is it that when we put our hand into the water we don't make a hole in it?[1] Where does the cold go to when I get warm? What is air?[2] These questions are typical of the kind of information which is wanted between the ages of four and six. The first two were asked by children who were playing at being animals and were anxious to make their play true to life. But the others arose directly out of the urge to interpret the new in terms of the old,

[1] Sully, *Children's Ways*, p 49 [2] Miss Murray

an urge which will leave neither child nor adult in peace, once he has become interested in a phenomenon which seems to belong to none of his existing stock of classes.

If a child were left entirely to his own resources, questions such as these would certainly have to remain unanswered, but as a rule he soon discovers that he can obtain much of the information he wants by merely asking for it. This does not mean that he loses his joy in experimentation. Unless he is overwhelmed with offers of help, he will still prefer to find out things for himself when they seem to be within his power. But for information which he cannot acquire by his own efforts he gradually learns to turn to others as a matter of course. At times he may have doubts about the correctness of some information. These doubts are, however, rare; for the superior wisdom of the adult world is so evident to him that he is on the whole prepared to accept its verdicts as final. And he is, moreover, often encouraged to think that there is some peculiar virtue in believing what one is being told without trying to test its value by asking further "unnecessary" questions. Thus most individuals tend to develop a strong authority complex under the influence of their early environment and are consequently highly suggestible to information which comes from a recognised leader, a teacher, or, for that matter, a book of any kind.

After the age of nine or ten the tendency to take

information on trust receives further impetus from the individual's growing need for community life, for practical experience quickly teaches every child that he will only be recognised as a member of a group, if he is willing to accept its opinions as well as its leaders, and that even expressions of doubt are liable to be interpreted as proofs of disloyalty. During the next few years the adolescent usually succeeds in identifying himself so completely with the school and the clubs to which he belongs that he resents an attack on them as an attack on himself. At the same time he becomes increasingly sensitive to criticism from his equals, for such criticism represents group opinion and group opinion his gregariousness is urging him to accept as infallible. As a result of all this, the adolescent is often extremely suggestible to information which comes to him from his own groups. Later his growing confidence in himself may make him a little more independent, but mass suggestion—as this sensitiveness to group opinion is usually called—remains a powerful force throughout life. And even the strongest of us fail to escape its influence when we are dealing with material which involves unknown or uncertain factors, as, for instance, in that large field of thought in which lack of knowledge forces us to content ourselves with psychological concepts and hypotheses.

One effect of this attitude is that we tend to take information on trust when it comes from one of

our own leaders or when it forms part of the stock of one of our own groups. To realise how important this is for our welfare, it will be worth while to consider what would happen to a child who was incapable of believing what he was told. Such a child would of necessity refuse to credit the existence of any phenomenon which was outside the range of his own experience as well as the result of any investigation which he had not repeated himself. It does not take much imagination to realise how difficult he would find it to acquire even that minimum of knowledge which would just enable him to hold his own in a community such as ours. Thanks to our suggestibility, we are, however, able to believe a statement, if it comes from a reliable source, and are, consequently, able to learn in a few years what it took centuries to discover. And, since information is primarily a tool for problem solving, this means in practice that our suggestibility adds immensely to our chances of well-being by enabling us to acquire a stock of tools which is incomparably larger and better than any which even the most capable of us could secure without it. At the same time it is of course liable to mislead us. It may put us at the mercy of the clever advertiser and make us the victim of newspaper propaganda. It tempts us to accept the work of a great thinker as infallible and makes it extremely difficult for us to reject an opinion which our fellows hold to be correct.

I have already had occasion to relate how certain Aristotelians refused to believe the evidence of their own senses when they saw a ten pound weight and a one pound weight fall to the ground in the same time, because it was contrary to Aristotle's teaching that a light weight should fall as quickly as a heavy one.[1] The biographies of reformers and investigators are full of similar instances. When a belief has had time to become well-established, an attack on it tends to be resented as an attack on the dignity of the group which holds it, and the authority complex is often so strong (especially among the rank and file of thinkers), that the mere age of a thought is treated as an index of its reality value.

It is due to this same combination of authority complex and what may perhaps be called "group complex" that a leader or group of leaders is often able to check the diffusion of a new idea by formally pronouncing that idea to be incorrect. Thus the French Academy was, for instance, able to check the spread of Evolution in France by declaring against it, and this long after it had become part of the accepted creed of the leading biologists of the day.[2]

As the biographies of workers show us again and again, the thinker who is responsible for a new idea does not escape the influence of suggestion. However sound his work, he is always tempted to judge its "real" value by the support it gets from his

[1] Cf p. 227. [2] Cf. Darwin, *op cit.*, p. 261.

reasoning was wrong, because it was based on an accidental property of "prayers said in bed" instead of being based on an essential.

If doubt is thrown on an assertion there are two ways of defending it: one is to give a practical demonstration of its truth, the other is to prove that it is a correct inference from what are known to be "sufficient" reasons. Of these the former is often held to be the more satisfactory, but that is only because it flatters the opponent's belief in his own power of interpretation, for it leaves him in reality at the mercy of his own complexes, and may therefore produce illusions and misinterpretations of all kinds.

I have already referred to Musschenbroeck's accidental discovery of the electric shock[1] Physicists tell us that the apparatus which he used was such that the actual shock must have been much weaker than those which are now taken for amusement even by children. But owing to the unexpectedness of the experience he felt that his frame had been shaken, as if by a stroke of lightning, and in his report declared, "I thought that all was over with me, for my arm and my whole body was affected in a dreadful way which I cannot describe." This exaggeration was of course quite unconscious, it was an illusion which was due to the strangeness and unexpectedness of the sensation. However,

[1] Cf p 199

what concerns us at the moment is the way in which his description of his own sensations affected those who first ventured to repeat his experiment. And it would seem that the authority complex of several of these was so strong, that they faithfully reproduced the whole of his experience. One of these, Winker, a professor of Leipzig, tells us that "his whole body was convulsed, and that his wife remained for a week scarcely able to move after she had experienced the shock."[1]

When an appeal to experience is impossible the only alternative is to find a reason which others will accept as final. But this is by no means easy, for our only reason for holding a belief is that it comes from a source which we trust, and we are, therefore, only able to convince our opponent, if the source in question happens to be one towards which he is also suggestible.

In the case of knowledge the position is different, for knowledge implies awareness of the properties of the class to which the problematic unit belongs, and a known fact can therefore be explained by reference to these properties. To take an example: If anyone refuses to believe that an iron ball will expand when heated, I can prove my assertion by referring to the fact that iron is known to expand when heated, and the proof can be thrown into the form

All iron objects expand when heated.

[1] Routledge, *History of Science*, pp. 324–5.

This ball is an iron object.

Therefore, this ball will expand when heated.

Contrast this with the following argument:

Whatever A says is true.

A says that this ball will expand when heated.

Therefore, it is true that this ball will expand when heated.

With regard to the actual behaviour of the ball, the inference is the same in both cases, and so far as the process of deduction is concerned, there is nothing to be said against either of them. The difference lies in the formulations of the problem. In the first we are led to ask, "What is the effect of heat on the volume of a piece of iron?" In the second, "What is the reliability of A's statements in terms of objective reality?" In the first our attention is drawn to a definite class "iron objects" which we expect to react in a definite way to definite stimuli, and the effect of heat can therefore be determined by means of suitable experiments and observations.[1]

On the other hand, of A's statements some will be the product of mass suggestion, others of prestige suggestion, others of personal experience, others of

[1] It will be seen that this in turn depends on the assumption that objective reality consists of units which can be grouped into classes with definite properties For the trained thinker this is a logical fiction, which is rendered necessary by the structure of our minds, but for the untrained thinker it is a belief which is based on the assumption that the psychologically real is of necessity also the objectively real. Cf Ch. XV.

problem solving. To determine the reliability of any of these would require a knowledge of A's psychology, which it would be impossible to secure. And all that observation can give us is at best that A has so far always proved reliable.

Finally, if we were asked to infer from this that he is incapable of making a mistake, the obvious retort would be .

All human beings are liable to err.

A is a human being.

Therefore A is liable to err.

A syllogism in which the general proposition is just as difficult to prove as the assertion that whatever A says is true.

But as a matter of fact the generalisation "Whatever A says is true" has only to be stated to be rejected. We do not believe in the infallibility of any human being, for we discover early in life that even our first heroes—our parents—are liable to make the strangest mistakes. In short, our relation to our leaders is emotional rather than rational, and in the sphere of knowledge their function is primarily to act as substitutes for the all-wise parent who solved our problems for us in infancy and childhood.

The same line of thought applies to the dicta of groups and to the interpretation of personal experience. It would be impossible to demonstrate the infallibility of a particular individual or group of individuals, yet there is always a tendency to

assume that one's *own* interpretations are correct, and that one's *own* group is right, the former because adaptation would be impossible without it, the latter because our need for companionship impels us to seek a larger self in which we can merge our individual selves.

We see, then, that the true reason for a belief is one which has only psychological reality. If I accept A as my leader in a certain sphere, then my desire to follow him will block impulsions to test the truth of his statements. For me they are true, because they are his, and for me that reason is quite sufficient. But it is not one which I can venture to give in a discussion, unless I am certain that my opponent is also a follower of A, for its logical unsoundness would immediately be detected by anyone who was not already under his influence. All I can say from the point of view of objective reality is "I hold this to be true," for the only reasons which have objective value are those which are based on the essential characters of the class, and those the true believer does not give a thought until he is called upon to defend his beliefs.

Owing to the mass of information which we absorb uncritically from our environment, we continually use beliefs in our efforts to adapt ourselves to our environment. One person puts the poker at right angles to the grate to make the fire burn up, another fixes a horse-shoe to his house

for luck. People who know nothing about the chemistry of food eat brown bread because it contains vitamins or give up eating it because it is too coarse to be wholesome. If we ask these people why the poker makes the fire burn up, or why coarse bread is unwholesome, they should by rights say "I don't know," adding at most the source from which they derive their belief.

In a few fundamental aids to adaptation, such as theories connected with the purpose of life, this is indeed the only possible answer, and it then depends on the temperament and training of the thinker, whether he prefers to express his conclusion in the form of a belief or in that of a logical fiction, for such problems are generally recognised to be too difficult to yield to methods of induction and deduction. But these are exceptions. In regard to most of our problems we are inclined to assume that every effect has a cause which can be discovered by anyone who thinks it worth his while, and in these cases the willingness to accept an important result on trust is often interpreted by the unbeliever as a sign of stupidity or indifference.

In this connection it is important to bear in mind that our solution of a problem may be correct when the reasons we give for it are worthless. For the solution depends on the ecphory of the configurations which the stimulus-set is able to throw into a state of activity; the discovery of the reason, on the awareness of the connecting links which led

to it. And experience shows that it is often easier to find the solution than to discover the process which led to it. In complex problems it is, therefore, as a rule wiser to state one's conclusions, without attempting to supply reasons for them. In this connection it is worth while to remember the advice which Lord Mansfield gave to a man of practical good sense, who, being appointed governor of a colony, had to preside in its court of justice without previous judicial practice or legal education. As is well known, the advice was to give his decision boldly, for it would probably be right, but never *to venture on assigning reasons, for they would* almost infallibly be wrong.[1]

A sufficient reason, that is to say, one which expresses an invariable sequence, is undoubtedly a thinking tool of the greatest value, for it enables us to foresee effects and at times to produce or prevent them at will. Unfortunately, from being useful tools, reasons tend to become symbols of power, with the result that a person begins to measure his worth by the number of effects for which he can produce some kind of a cause. This is no doubt partly due to the feeling of mastery which accompanies the discovery of an invariable sequence, but the tendency must be greatly strengthened by the attitude of the environment with which we have to reckon in childhood and adolescence.

[1] Quoted by J. S. Mill, *System of Logic*, i, p 217, ed. 1879.

Because a reason is a symbol of power, man likes to think of himself as a reasoning being, and because he certainly has sufficient reasons for some of his actions, he readily persuades himself that he has or should have sufficient reasons for all. As we have seen in previous chapters, many of our daily problems are far too complex to yield to ordinary methods of attack, and it is, therefore, extremely unlikely that man will ever have sufficient reasons for all he thinks and does. But our primitive egotism is so strong, that we are usually able to deceive ourselves on this point, and it is only the specially trained mind which detects the blockages and the false explanations with which we habitually hide our failures from ourselves. The result is that every human being is expected to have a reason for all his thoughts and actions, and that mass suggestion quickly teaches each one of us that we shall not be recognised as equals, if we cannot produce reasons for our behaviour.

In the average environment this is a lesson which is learnt long before the beginning of adolescence. Occasionally a child will venture to assert that he does not know why he did a foolish thing, or why he believed an incorrect statement to be true, but experience soon teaches him that there are only two possible explanations for such ignorance: either he is intensely stupid or else he is being tiresome on purpose. His egotism makes him resent the idea that he is stupid, and he knows quite well

that he did not consciously mean to be tiresome. Hence the obvious conclusion is that he ought to have reasons for his actions, and under the influence of his desire for approval he promptly sets to work to find those reasons. It should be noticed that the child is as a rule perfectly honest in his attempt to find why he did a thing or why he wants to do it. Now and then he may invent an excuse and know he is inventing it, but observation shows that his reasons are as a rule the product of unconscious construction under the influence of a felt need and are for him true explanations of his behaviour. Moreover, if they were not, they would fail in their main purpose, which is to prove to his conscious self that he is like his fellows, a reasoning being.

I have already had occasion to refer to the little stammerer, who thought she could not say "two" because it was harder to say than "one."[1] In much the same way another child assured me that she could not learn to spell, because her mother was a poor speller, and a clever girl of eighteen, who was working for a mathematical scholarship, that she could not write legibly, because the writing of mathematicians was always illegible. I have reason to know that every one of these explanations was perfectly honest, so far as the speaker was concerned. They were in fact one and all the product of unconscious construction under the influence of the desire to account for a failing which the conscious

[1] Cf. p 80.

self was unable to control. And their survival value lay in the fact that they provided a way out of a struggle, which might otherwise have ended in the defeat of the conscious self.

For these pseudo-reasons which are produced under the influence of the desire to prove that we are reasoning beings, Ernest Jones has coined the term "rationalisations." He says: "No one will admit that he ever deliberately performed an irrational act, and any act that might appear so is immediately justified by distorting the mental processes concerned, and providing a false explanation that has a plausible ring of rationality. This justification bears a special relation to the prevailing opinion of the circle of people who are most significant to the individual concerned, and two different sorts of false explanations can be distinguished according as they are formed essentially for the individual himself, or for him in special reference to the opinions of his circle; the former of these I would term 'evasions,' the latter 'rationalisations'. there is, however, no sharp line dividing the two, and perhaps it would be better to employ the latter term for both processes."[1]

What degree of skill we develop in the manufacture of rationalisations will depend partly on our constructive power, partly on our environment. The stupid child soon discovers that his "reasons" deceive no one but himself, with the result that he

[1] *Essays in Psycho-Analysis*, ed 1918, p. 13.

often finds himself accused of inventing excuses when he is really giving what seems to him a perfectly sound reason for his behaviour. On the other hand the clever child carries away the impression that his reasons are usually sound, for his greater intelligence enables him to construct sequences which do not contain so many obvious flaws.

Whilst the degree of success which the child achieves depends on his intelligence, the impetus to acquire the necessary skill is undoubtedly derived from the environment. In many surroundings the power to produce a reason which will pass muster is as important to personal well-being as the willingness to obey commands without enquiring into their purpose. It is perhaps only natural that an intelligent individual who grows up in an environment of this kind often learns to invent excuses of all kinds with amazing rapidity, excuses which are sometimes honest rationalisations, at others mere evasions, but which all have this in common, that they save their creator the humiliation of having to own that he is capable of doing things without knowing why he does them.

In childhood our search for reasons centres in the main round the ever-present need to explain our actions. In adolescence it begins to concern our beliefs as well, for adolescence is the period in which we are first thrown into contact with individuals who follow different leaders, and who are consequently not prepared to accept our beliefs on the strength of their origin. To defend these

beliefs we have once again to produce adequate reasons, and since we have usually not sufficient knowledge to discover objective truth, the reasons which we discover are once again rationalisations. This is a difficulty which pursues us through life, and is responsible for many of the pseudo-reasons with which we support our beliefs.

An instance of this is found in the history of the phlogiston theory, to which reference was made in Chapter X.[1] As we saw there, Stahl assumed that metals lose a substance "phlogiston" when they are burnt to ash. Stahl was working before the time of Priestley and had therefore not had his attention drawn to the fact that metals may join with part of the air in which they are being heated. But he was a man of great natural ability, and it is at least conceivable that he might have thought it worth while to see whether the burning was in any way dependent on the presence of air, if he had not had two good reasons for believing in the correctness of the phlogiston theory. These were (1) that the theory was in accordance with his philosophy and (2) that he found he could use it to explain phenomena as diverse as the burning of metals and the breathing of animals. In terms of the psychology of belief this means that the theory had behind it (1) a well-organised system of conscious and unconscious complexes and (2) the ever-active urge to classify. It is therefore not strange to find that Stahl felt con-

[1] Cf p. 224

vinced that he had discovered the true explanation of the phenomenon. The only difficulty was that his theory did not explain the observed increase in weight. Stahl overcame this by suggesting that the metal must combine with a "pure fire" which is heavy enough to account both for the increase in weight and for the loss of phlogiston. Though logically sound this theory was shown to be open to a number of objections, but Stahl was incapable of learning from criticism. He was by disposition difficult and obstinate, and inclined to think it an insult to be asked to reconsider an idea once he had formulated it. Hence he took for granted that his theories were right and that all that was needed was to explain away the objections. In short, it was possible for Stahl to believe his theory was correct, because it covered the facts as far as they were known in his time. But the vigour with which he defended his explanation of the increase in weight and the way in which he resented attacks on it were due partly to the complexes to which the theory owed its power to produce so strong a feeling of conviction, partly to that primitive belief in the products of his own mind which Stahl apparently displayed in the face of all criticism.[1]

[1] Cf p 258 for account of Kepler's attitude towards the products of his own mind.

For the character of Stahl see Albert Lemoine, *Le Vitalisme et l'Animisme de Stahl.* Bibliothèque de Philosophie Contemporaine, 1864

However strong his desire to prove the truth of his assertions, Stahl was too careful a worker to propound a theory which was not consistent with the assumptions on which his work was based. Some of his followers, however, ventured to assert in all seriousness that phlogiston must be of the nature of a levitating agent—a theory which would render the whole study of chemistry impossible, since that science depends on the assumption that an increase in weight always indicates an increase in substance. There is of course nothing inherently impossible in such a theory; the point is that students of chemistry were able to enunciate it without realising that it would, if true, shake their science to its foundations. I have mentioned it here because it is a good instance of the way in which the desire to believe may block access to facts of which the thinker is perfectly well aware.[1]

To sum up: Reasons are essentially tools for thinking, they enable us to foretell what will happen under circumstances which have not occurred before and to judge the correctness of the solutions which flash upon the conscious self from unconscious sources. And, since it is not generally recognised how difficult it is to know the cause of anything, the person who has not got an adequate reason for what he is doing is usually felt to be lacking in some way. Thus the possession of

[1] Cf. p. 228 for account of Glanvil's attitude towards witchcraft

a reason has become a valued symbol of power and the search for it an end in itself. But what is needed to satisfy our love of mastery is merely a reason which will pass muster with the aid of the existing blockages. Hence our desire to prove to ourselves that we have a good reason, for all we think and do is likely to produce rationalisations rather than reasons.

BIBLIOGRAPHY

Psychology and Philosophy

Aveling . The Consciousness of the Universal.
Betts The Distribution and Function of Mental Imagery
Freud The Interpretation of Dreams.
—— The Psychopathology of Everyday Life.
—— Introductory Lectures in Psycho-Analysis
Graves : On English Poetry
James Principles of Psychology.
Jones : Essays in Psycho-Analysis.
Kohler . The Mentality of Apes.
Koffka The Growth of the Mind.
Meumann : Vorlesungen zur Einfuhrung in die Experimentelle Padagogik.
Muscio : Lectures on Industrial Psychology.
Prescott . The Poetic Mind.
Russell : Introduction to Mathematical Philosophy.
Semon : The Mneme.
Sleight : Memory and Formal Training. B J.P. Vol IV.
Spearman : The Nature of Intelligence and the Principles of Cognition
Sully · Children's Ways.
Tansley . The New Psychology.
Tree . The Imaginative Faculty.
Vaihinger The Philosophy of 'As if'
Wohlgemuth On Memory and the Direction of Associations B J P Vol V

Biography and Autobiography

Darwin : The Life of Darwin.
Drinkwater, afterwards Bethune · The Life of Galileo.
Helen Keller · *The Story of My Life.*
Lemoine : Le Vitalisme et l'Animisme de Stahl.
Luther : Life of, collected and arranged by Michelet, translated by W Hazlitt.
McCurdy : Leonardo da Vinci.
Roeckl : What does Wagner tell us about the Origin of the Nibelungen Poem ?
Trotzky : Lenin.
Russel Wallace . My Life.

Miscellaneous

Avebury Prehistoric Times.
Berthelot La Révolution Chimique Lavoisier
Frazer The Golden Bough
—— Taboo
—— Psyche's Task
Lecky History of the Rise and Influence of the Spirit of Rationalism in Europe
Lee · The Handling of Words
Markham : Major James Rennell and the Rise of Modern Geography
Marshall : Principles of Economics
Milhaud : Les Philosophes Géomètres de la Grèce
Gilbert Murray Essays and Addresses.
Middleton Murry . The Problem of Style
Routledge : History of Science.
Adam Smith : Wealth of Nations.
Stevenson Familiar Studies of Men and Books.
Tylor : Primitive Culture.

APPENDIX

As it may be a convenience to some readers, I restate here definitions of technical terms which have been used in the text.

Absorption, Attention, and Awareness

Absorption is the mental state which is produced when one complex is ecphoring so vigorously, that it is able to block all others.

Attention is the mental state of tension of which we become aware when the environment is causing ecphory within incompatible complexes of which neither is strong enough to block the other completely.

Awareness is the mental state which is produced when a stimulus ecphores a rival complex or a reflex in such a way that it blocks the flow of thought sufficiently to force its existence upon the conscious self.[1]

Association

Engrams, which are ecphoring at the same time in response to the same need, tend to become associated together in such a way that ecphory

[1] Cf. p 43

thereafter spreads readily from one to the other.[1] When a stimulus has acted on an organism, the excitation to which it has given rise continues for a short time after it has been removed. Hence, when a series of stimuli *a*, *b*, *c*, etc., is being applied, the engram of *a* is still ecphoring when *b* is engraving its engram, with the result that the engrams of *a* and *b* are ecphoring at the same time, and are consequently associated together under the influence of *simultaneous ecphory*. Thus the association of engrams which are formed successively is really a particular case of the association of engrams which are formed simultaneously.[2]

Complex

A *complex* is a configuration of engram-sets which contains impulses within its system. It is the mechanism by which Nature enables us to adapt impulsive activity to our needs.[3]

When a complex forms part of the system of the conscious self, we call it a *conscious* complex, when it does not form part of that system we call it an *unconscious* complex.[4]

Concept

A concept is an item of awareness considered in respect of its essential *characters* and without refer-

[1] Cf. p 128.
[2] Cf p. 125
[3] Cf. pp 46 ff.
[4] Cf pp 52 ff.

ence to any particular occurrence. The *characters* of a concept are those of its properties, *i.e.* qualities and possibilities which enable us to realise its existence as an independent entity. Hence its characters do not include attributes which involve a relation.[1]

The *object concept* enables us to think of a class of objects without reference to a particular specimen; the *property concept* of properties, *i.e.* qualities or possibilities, as though they had individual existence apart from the objects in which they occur.[2]

The *psychological concept* is a product of natural growth. It develops under the influence of experience without the aid of conscious analysis. In the case of objects it is of necessity the concept of a class, in the case of properties it may be that of a class or of an experience.

The *logical concept* is a product of conscious analysis: it is the concept of a class of which the essential characters have been determined with the aid of some form of problem solving.[3]

Configuration

A *configuration of engram-sets* is a group which has become associated together in such a way that ecphory spreads readily from point to point, with the result that the group is able to function more or less completely as a unitary whole.[4]

[1] Cf p 231
[2] Cf. pp 240 ff
[3] Cf. pp 254 ff
[4] Cf p. 13.

A *mental configuration* is the effect which the existence of such a group has on the mental outfit of an individual when it forms part of his conscious system. Koffka defines it as "a coexistence of phenomena in which each member carries every other, and in which each member possesses its peculiarity only by virtue of and in connection with all the others."[1]

Construct

If an individual discovers a way of attaining an end which has, so far as he knows, not been used before, his discovery is called a *construct*. If he becomes aware of it as an idea, it is called a *mental construct* The act of forming a construct may be called an *act of construction*, and the power of the mind which renders construction possible its *constructive power*.[2]

Deduction

In deduction the essential characters of the relevant classes are always assumed to be known with sufficient accuracy, and the aim is to use them to discover the attributes of the *problematic unit*, that is to say, of the particular individual or sub-class about which there is not sufficient knowledge available.[3]

[1] Cf p 14. [2] Cf. Ch VIII. [3] Cf p 282

Engram and Ecphory

If a phenomenon is able to function as a stimulus, it tends to produce a permanent change within the organism. This permanent change Semon calls an *engram* because it has, as it were, been " written on " the organism. When the stimulus is repeated, the energy which it sets free flows through this new engram with the result that it takes a more or less different path, and consequently leads to a more or less different form of reaction. This process Semon calls the *ecphory* of the engram because it " brings forth " the change which was wrought by the first application of the stimulus.[1]

Identification

The mechanism of identification is an inborn property which enables the individual to merge himself so completely in his heroes that he is able to treat their victories and defeats as though they were his own, and even to endow himself in thought with their power and their skill.[2]

Impulse

An impulse is an inborn tendency to seek a certain end in certain situations. (It makes us want to avoid danger, to remove obstacles from our path, etc.) It is roused by all percepts and ideas

[1] Cf p 11 [2] Cf p 50

which seem to the individual to suggest one of these situations, and it may seek to attain its end by any of the means which he has learnt to use for that purpose. An impulse is therefore an inborn engram-set.

Impulsion

Under the influence of experience, impulses become organised into the configurations of complexes. When a stimulus ecphores an impulse within such a configuration, the resulting urge to act is termed an *impulsion*.

Induction

The purpose of induction is to discover the essential properties of a class concept with the aid of the known properties of its members. Whereas in deduction it is the unit which is problematic, in induction it is some character of the class concept itself, the units being supposed to be known with sufficient accuracy.[1]

Interest

A stimulus-set arouses *interest* whilst it is being studied and classified in relation to a particular need. Interest is therefore the mental state of which we become aware, whilst the engrams which the stimulus-set is engraving are actually being in-

[1] Cf. pp 268 ff.

corporated within the configuration which it has ecphored.[1]

Logical Fiction

A logical fiction is a logical concept which is known and intended to be an incorrect representation of objective reality. It is a tool which the worker has constructed for a special purpose, and which he intends to discard as soon as he can do without it.[2]

Law of Mutual Blockage

The law of mutual blockage is the tendency of a strong complex to block its rivals in such a way that they cannot affect behaviour, and is, therefore, able to express itself in action without being checked by other needs of the self. It should be noticed that this law applies primarily to parts of a system which are *for the time being* able to block other parts, but that it also accounts for the way in which configurations tend to function as independent wholes, until they have been linked together under the influence of simultaneous ecphory.[3]

Nervous Energy

Every stimulus produces a physiological change within an organism, and every physiological change

[1] Cf. pp 40 ff [2] Cf. p. 296 [3] Cf p. 45, and p 47.

involves physiological activity or excitation. *Nervous energy* is the term which has been used here for the energy which produces this excitation, and *flow of nervous energy* for the conduction of the effect of a stimulus through the nervous system.[1]

Percept

When a stimulus-set ecphores previously established engrams in such a way that we become aware of its meaning, we call the information we obtain in this way a *percept*, and the act of obtaining it an act of perceiving.[2]

Primitive Egotism

The primitive egotism of an individual is his inborn tendency to behave, and to expect others to behave, as though he were the most important person of his community. This tendency is very strong in all of us. After early childhood it is, however, normally kept in check by other rival tendencies.[3]

Psycho-analysis

Psycho-analysis may be defined as the study of unconscious mentation with the aid of an elaborate technique which is based on the method of free associations (cf. Bibliography).

[1] Cf. p. 10. [2] Cf. p. 104 [3] Cf pp 48 ff.

Reason and Rationalisation

A sufficient reason is one which expresses an invariable sequence, that is to say, one which explains the behaviour of a unit by reference to an essential character of the class to which that unit belongs.[1]

A rationalisation is a pseudo-reason which the individual has constructed in service of his desire to prove himself a reasoning being. It is the product of unconscious problem solving, and is accepted by the conscious self as a sufficient reason.[2]

Reflex

A reflex is an inborn tendency to react in one specific way to one specific stimulus or stimulus-set.

Stimulus

A stimulus is an action on an organism which produces a physiological change within that organism.

Suggestibility

The *suggestibility* of an individual is his tendency to accept information uncritically when it comes from a suitable source. That source may be a father-substitute of some kind, *i.e.* teacher, leader, or it may be one of the groups to which he belongs.

[1] Cf pp 323 ff. [2] Cf p. 333

In the former case his attitude is said to be due to *prestige suggestion*, in the latter to *mass suggestion*.

Thinking

Thinking is ecphory within a configuration. Much of our thinking is unconscious. It is only when the configuration which is ecphoring forms part of the conscious self, and when the impulsion is blocked by some obstacle, that we become aware of thoughts.[1]

[1] Cf pp 56 ff.

INDEX